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Prevalence of Dental Diseases Against the Background of Endemic Goiter in the Iodine-Deficient Region of the Samarkand Region

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Abstract

The number of thyroid diseases is growing all over the world. Thyroid pathology ranks second among all endocrine diseases after diabetes mellitus. This is due to the impact of exogenous factors: lack of iodine in the environment, the effect of various strumogenic factors, deterioration of the environmental situation, improved diagnosis of thyroid nodules. Hypothyroidism is associated with a high incidence of inflammatory periodontal diseases. Experiments on laboratory animals showed that the highest level of periodontal tissue damage was in animals with experimental hypothyroidism. Studying the influence of thyroid pathology on the condition of periodontal tissues is also important due to the fact that one of its diseases – hypothyroidism of the thyroid gland – is quite widespread, especially in regions with a lack of a number of natural focal factors-iodine and fluoride.

Keywords: thyroid gland, diffuse endemic goiter, hypothyroidism, periodontal disease, hard dental tissues

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Распространенность стоматологических заболеваний на фоне эндемического зоба в йододефицитном регионе Самаркандской области

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Резюме

Число заболеваний щитовидной железы растет во всем мире. Патология щитовидной железы занимает второе место среди всех эндокринных заболеваний после

сахарного диабета. Это связано с воздействием экзогенных факторов: недостатком йода в окружающей среде, действием различных струмогенных факторов, ухудшением экологической обстановки, улучшением диагностики узлов щитовидной железы. Гипотиреоз связан с высокой частотой воспалительных заболеваний пародонта. Эксперименты на лабораторных животных показали, что наиболее высокий уровень поражения тканей пародонта наблюдался у животных с экспериментальным гипотиреозом. Изучение влияния патологии щитовидной железы на состояние тканей пародонта актуально еще и в связи с тем, что одно из ее заболеваний – гипотиреоз щитовидной железы – достаточно широко распространено, особенно в регионах с недостатком ряда природных очаговых факторов – йода и фторида.

Ключевые слова: щитовидная железа, диффузный эндемический зоб, гипотиреоз, заболевания пародонта, твердые ткани зубов

There is a lot of data on the combination of generalized inflammatory periodontal lesions with various diseases of internal organs. Maksimov M.Yu. (2016) and Startsev A.L. (2018) in their works confirm the effect of iodine deficiency on periodontal tissues.

However, there are few studies proving the relationship between periodontitis and hypothyroidism and the effectiveness of its prevention and treatment in such patients.

Thyroid gland dysfunction contributes to the development and spread of caries, changes in the mineralization of hard tooth tissues, and periodontal pathology (Zolotinsky I.Yu., 7201-7). It is noted that in women aged 18–50 years, the enamel of intact teeth shows an increase in the diameter of enamel prisms in hypothyroidism, as well as thickening, loosening, violation of the shape of enamel prisms and dentin deformation with destruction of tubules in caries foci in hypothyroidism, but the nature of morphological changes in hypothyroidism during hormone replacement therapy remains poorly understood. Taking into account the above, early diagnosis of the pathological state of the hard tissues of the teeth and periodontium in patients suffering from thyroid disorders and timely implementation of therapeutic and preventive measures is very valuable.

Hypothyroidism is a clinical syndrome caused by a persistent decrease in the level of thyroid hormones (thyroid hormones) in the blood. Hypothyroidism affects all body tissues and is one of the most common diseases of the endocrine system, so this problem has become relevant for a large number of specialists. In recent years, the prevalence of this condition has significantly increased in all regions of Russia and the world, which is associated with an increase in the detection rate of the disease. Factors such as environmental degradation, insufficient dietary intake of iodine, and an increase in the incidence of autoimmune diseases also have an adverse effect [3, 4, 13].

There are several forms of hypothyroidism. Depending on the degree of involvement in the process, it can be divided into primary (associated with thyroid pathology) and central (associated with a violation of the trophic function of the pituitary gland). Peripheral hypothyroidism is extremely rare and is characterized by insensitivity of tissues to the action of thyroid hormones. According to the degree of severity, there is a distinction between manifest and synclinical hypothyroidism [5, 6]. Manifest or (open) diffuse endemic goiteris characterized by an increase in TSH (thyroid-stimulating hormone) and a decrease in T4 and T3 levels. As a rule, the disease is accompanied by a detailed clinical



picture and, according to statistics, occurs in about 2–3% of the Russian population. Latent or occult hypothyroidism is diagnosed with normal T4 and T3 levels and elevated TSH levels and occurs in 10 % of the adult population and 3 % of children [7, 9, 12].

Hypothyroidism is significantly less common in men than in women (3–9 times); according to Vanderpump MPJ, Tunbridge WMG, and French JM (20–16), the prevalence of newly diagnosed overt hypothyroidism was 3 cases per 1000 women. The overall prevalence of hypothyroidism in men was 1 case per 1000 [4]. Transient postpartum hypothyroidism occurs in 5–10% of women. On average, 5% of subclinical hypothyroidism progresses annually to open hypothyroidism [3, 10]. The average age of patients with hypothyroidism is 50–60 years [1].

According to the recommendations of the Association of Endocrinologists, the diagnosis of autoimmune thyroiditis (AIT) cannot be confirmed only by palpation of the thyroid gland (increase or decrease in volume). The main diagnostic features are the following:

- diffuse endemic goiter (manifest or persistent latent);
- detection of antibody titers against thyroid tissue;
- ultrasound signs of autoimmune pathology.

The diagnosis of AIT is probable only in the absence of at least one "basic" diagnostic sign [3]. Percutaneous thyroid biopsy is not a diagnostic method for AIT. Dynamic studies of titers of circulating antibodies to thyroid tissue have no diagnostic or prognostic value [5].

Low levels of thyroid hormones affect all metabolic processes in the body. Hypothyroidism is characterized by a decrease in the metabolic rate, which is manifested by a decrease in oxygen demand, blunted redox reactions, and a decrease in basal metabolic parameters. In addition, both catabolic and anabolic processes are disrupted. The body accumulates glycosaminoglycans, protein breakdown products, glucuronic acid and chondroitinsulfate. These substances become more hydrophilic and contribute to the accumulation of fluid and sodium.

In the clinical picture of hypothyroidism, several syndromes can be distinguished: hypothermia, metabolic disorders, arterial hypertension, heart rhythm disorders, anemia, hypoxemia syndrome, digestive damage syndrome, edema, hypothyroid dermatosis, hypothyroid neuropathy and hyperprolactinemic hypogonadism. Patients with severe hypothyroidism develop severe myxedema (myxoedema) [8, 9].

We examined 75 patients with caries and chronic generalized periodontitis on the background of diffuse endemic goiter, living in the iodine-deficient region (Nurabad district, Samarkand region) aged 25–45 years. The comparison group consisted of 40 patients with caries and inflammatory periodontal diseases who do not have somatic pathology and do not live in an endemic zone.

To assess the condition and structure of the bone tissue of the alveolar process of the jaws, X-ray methods were used, mainly orthopantomography and intraoral contact radiography. Orthopantomography was performed using an Orthophos 3 Ceph device (Sirona Dental Systems GmbH, Germany). The main X-ray signs of periodontal diseases were: enlargement of the periodontal fissure, changes in the structure of bone tissue of the alveolar bone, destruction of the closed cortical plate of the interalveolar ridge, formation of bone pockets, destruction of bone tissue of the interalveolar fissure and a decrease in its height.

The condition of the bone tissue of the alveolar process of the jaws was evaluated by measuring the Fucsh bone index (1946) – Fucsh index (FI). The condition of bone tissue was assessed by orthopantomograms.

Identification of microbial species in the contents of periodontal pockets was carried out using molecular genetic methods using polymerase chain reaction (PCR) [2]. PCR is a highly sensitive method and allows identifying the most common causes of periodontal diseases – *Porphyromonas gingivalis*, *Actinobacillus actinomycetemcomitans*, *Treponema denticola*, *Bacteroides forsythus* and *Prevotella intermedia*. This method makes it possible to identify five main periodontal pathogenic microorganisms, as well as antibiotic resistance genes [12].

The simplified Oral Hygiene Index (OH-S) was analyzed. In patients with thyroid diseases (endemic goiter), an increase in this indicator was observed compared to the control group. A low hygiene index of 1.2 ± 0.15 in the control group aged 25–35 years indicates a good hygienic condition of the oral cavity. The hygiene index in the group with diffuse endemic goiter was almost 2 times higher than in the control group.

The hygiene index was higher in the 36–45-year-old age group. In the control group, this index was significantly lower (1.8 ± 0.20) and close to a high value of 2.6 ± 0.31 in patients with diffuse anemic goiter.

Overall, the hygiene index increased with age in both groups. These changes may be related to age-related physiological processes and disease progression, as well as possible deficiencies in hygiene knowledge and manual oral hygiene techniques. With an average assessment of the indices in both groups, it was found that this index in the group with diffuse endemic goiteris was 1.55 times higher than in the control group. Thus, the population health index shows the influence of thyroid pathology (diffuse anemic goiter) on the amount of plaque deposits.

The Loe, Silness index reflects the state of the gums: the presence of inflammation and its severity (the rate and presence of plaque accumulation). In the age group of 25–35 years, the presence of inflammatory phenomena, manifested in the form of gingivitis, was noted.

The gingival index in the control group was low, in the main group the index was 1.52 ± 0.10 , which reflects moderate gingivitis, but about one, which indicates a borderline state between mild and moderate inflammation.

Severe gingivitis prevailed in the age group of 36–45 years. The lowest index in the control group was 2.22 ± 0.11 , which is 0.40 lower than in patients of the main group. Gingivitis was moderate to severe in both groups. The gingival index was higher in the main group than in the control group.

The development of inflammatory and inflammatory-destructive diseases in periodontal tissues is expressed by the Russell index. Analysis of the Russell index values in both groups aged 25–35 years showed that the index was lower in this age group. In the group with diffuse endemic goiter, the index was 3.1 ± 0.40 , which is 2 times higher than in the control group. The data obtained indicated the presence of moderate periodontitis.

The Russell index was highest in the 36–45-year-old age group. The severity of periodontitis in diffuse endemic goiter in the control group was moderate. On the contrary, in the main group it was 4.0 ± 0.22 and was at the threshold level.

The Russell index was significantly lower in the control group than in the group of patients with endemic hypothyroidism. In the second age group of patients with diffuse



endemic goiter, the Russell index differed from the control group by 1.8 and 3.55, respectively.

The difference between the two groups was 1.5 and 0.6, respectively. The results obtained indicate that in patients with diffuse endemic goiter, the inflammatory process is more active, as evidenced by an increase in the Russell index, one of the indicators of hypothyroidism intensity.

The OHI-S hygiene index has a direct impact on the gingival index. This is due to the fact that non-mineralized dental deposits (soft microbial plaque, food residues) and tartar, mineralized particles of which are ideal soil for the growth of pathogenic microflora, cause periodontal diseases. The higher the simplified Green-Vermillion hygiene index, the higher the gingival GI index. This relationship can be traced when analyzing the table data – the index values are expressed to a greater extent in the group of patients with endemic goiter.

When comparing the group of patients with diffuse endemic goiter, the OHI-S index and the gingival index showed higher values than in the control group. Thus, the GI index was increased in patients with endemic goiter as a result of impaired self-cleaning of the oral cavity. This indicates a link between the presence of the disease and an increased amount of dental deposits.

On the radiograph with diffuse endemic goiter, we observe a decrease in bone tissue in the upper and lower jaw with a visible decrease in the height of the alveolar process, smoothing of the interalveolar septa. Resorption of bone tissue of the alveolar process by 1/3–1/2 of the height of the interdental septum. Mobility of teeth of II–III degree. Deep bone pockets are expressed in the area of teeth 3.5, 3.7, 4.3. Subgingival dental deposits, cervical caries, and a significant number of sealed teeth were detected [11]. The presence of a bridge-like structure in the area of teeth 2.4, 2.5, 2.6, 2.7. The CPI index is eighteen. The overall picture corresponds to generalized periodontitis of moderate severity.

Analysis of orthopantograms of patients with diffuse endemic goiter confirmed the presence of periodontitis, showing that cortical plaque resorption and a decrease in the height of the interdental septum were detected in 45% of cases. In addition, periodontitis occurred in 50% (20 cases) of patients with diffuse endemic goiter. In other words, 20 out of 40 patients with diffuse endemic goiter suffered from periodontitis; in seven cases, periodontitis was mild, in nine – moderate and in four – severe. In the control group, periodontitis was observed in only 10 patients. The incidence of periodontitis was higher in patients with diffuse endemic goiter (50%) than in patients without thyroid involvement (25%).

Our clinical studies have shown that patients with diffuse endemic goiter have increased erosion of hard dental tissues. In the case of patient P. (37 years old), there is an increased erosion of the incisors of the front teeth and the occlusal surface of the masticatory zone compared to patients without thyroid damage. On the front teeth there are restorations (the border between the filling and the tooth is visible), the enamel is grayish in color.

To complete the tasks set in the period 2020–2023, we conducted a laboratory study of 75 patients. The study of patients included the study of parameters that characterize the state of periodontal tissues, thyroid gland, albumin binding ability, and immune system. All patients were examined by endocrinologists of the Samarkand Endocrinological Dispensary. Together with immunologists, a questionnaire was developed to assess

the presence or absence of factors contributing to the development of secondary immunodeficiency.

To identify secondary immunodeficiency conditions, life histories were collected and questionnaires filled out by patients were studied in order to identify typical immunopathological syndromes: infectious, allergic, and autoimmune. In the main group, 68.4% of patients had infectious syndromes, 42.5% – allergic and 54.9% – autoimmune syndromes. In the comparison group, infectious syndromes were detected in 17.4%, allergic – in 12.1%, and autoimmune – in 7.3%.

Patients of the main group complained of exposure of the necks and roots of the teeth, increased sensitivity of the teeth when exposed to temperature and chemical stimuli, dental defects in the cervical region, tooth mobility, and periodic bleeding of the gums during brushing. Patients with CGP without thyroid pathology complained mainly of severe bleeding of the gums during brushing and spontaneous bleeding, purulent discharge from the periodontal pocket, changes in the position of the teeth, pain in the gums, and tooth mobility. When studying the nature and frequency of occurrence of certain complaints in patients of the main and comparison groups, it was found that patients of the main group with both subclinical and manifest forms of primary hypothyroidism were 3 times more likely than patients of the comparison group to complain about exposing the roots of teeth (84% and 28%); about the presence of dental defects in the cervical region (89%), which exceeded those in the comparison group by 6.4 times (14%). Complaints of dental hyperesthesia were 2.2 times more frequent in the main group than in the comparison group (68% and 32%).

As a result of comparative analysis of cytograms in patients with diffuse endemic goiter, characteristic features of the cytological picture of periodontitis in patients with primary hypothyroidism were revealed: moderate leukocyte infiltration, the absence of immunocompetent cells, indicating a decrease in protective processes in periodontitis with the development of chronic inflammation.

To quantify the morphological features of the course of periodontitis against the background of thyroid hypofunction and compare them with the features of clinical manifestations, a cytomorphometric study was conducted for the first time in this cohort of patients. It was found that the cytomorphometric parameters of VDI and ID in patients with periodontitis on the background of primary hypothyroidism significantly exceeded those in patients with periodontitis without thyroid pathology: VDI – 1.4 times (27.5%) and ID-1.3 times ($p<0.05$ according to the Mann – Whitney criterion). High VDI values in patients of the main group (main group 55.78 ± 5.56 ; comparison group 40.44 ± 4.57) are due to the absence or low level of immunocompetent cells in cytograms detected by cytomorphometry, which indicates a decrease in the activity of protective mechanisms in periodontitis with the development of an inflammatory process against the background of thyroid hypofunction. High ID values in periodontitis in patients with diffuse endemic goiter (main group 3125 ± 290.4 ; comparison group 2345 ± 198) are due to the high level of contaminated and damaged gum epithelial cells.

■ CONCLUSION

A decrease in the adaptive capabilities of the body was found due to the negative impact of foci of chronic infection in the chronic prolonged course of periodontitis on the background of hypothyroidism. The revealed features of pathological processes in



the body of patients with diffuse endemic goiter should be taken into account when conducting complex treatment. The detected violations allow us to justify the use of immunomodulatory therapy in the complex treatment of this contingent of patients, local antibacterial treatment to exclude the immunosuppressive effect of systemic antimicrobial therapy in patients with an established secondary immune deficiency condition. The use of optimizers of regenerative processes at the surgical stage of treatment in patients with thyroid hypofunction is necessary due to a slowdown in the healing rate due to a decrease in the intensity of basal metabolism in the body. Complex treatment using the proposed methods leads to the achievement of stable remission, normalization of immunological disorders and elimination of endogenous intoxication of the body.

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