

Osteopenia Leading to Dystrophy of Alveolar Ridges at Persons Suffering from Hypothyroidism

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Abstract – The paper presents the study of features of parodontium microhaemodynamics via laser doppler flowmetry at patients with osteopenia caused by hypothyroidism. The study covered patients of 30–57 years old, among which there were 35 women and 20 men. Adequate hormonal therapy was carried out in the main group. Comparison with the control group where patients refused hormonal therapy was made. The integrated blood flow indicator, blood flow intensity, indicators of active and passive blood flow regulation, level of oxygenation of tissues was defined. The dental status was estimated. Blood test to assess the level of calcium, thyrotrophin-releasing hormone was made. It is defined that the hygienic indexes in the main group are better than in the control one. In the main group the oxygenation level of parodontium tissues is also higher. The resorption of jaw osseous structure in the control group is more expressed. At assessment of CFE index showed considerable number of extracted teeth in the control group. Biochemical indicators in the control group are less stable, which is expressed by considerable distribution of the calcium level in blood of the control group. The study showed that adequate hormonal therapy at hypothyroidism allows considerably reducing changes of jaw osseous structure and ensuring successful prosthetics of oral cavity.

Key words – *osteopenia, dystrophy of alveolar ridges, hypothyroidism*

I. INTRODUCTION

Continuing destruction of ecosystem, including mountain territories, violation of lifestyle and nutritive disturbance of the population led to current increase in the number of patients with diseases of thyroid and parathyroid glands. Besides specific effects, these glands have a marked impact on phosphorus-calcium metabolism, and thus released hormones may lead to bone mass dyspoiesis [1]. It is known that hyperthyroidism leads to accelerated bone metabolism; hypothyroidism, on the contrary, delays the growth of bone tissue. As a result of hypothyroidism we observe the disorder of normal mineral remodeling not only of skeleton bones, but also of alveolar ridges.

According to different domestic and foreign epidemiological studies, the prevalence of hypothyroidism is different in certain population groups and reaches 10–12 % in the general population and 7–26 % among elderly people [2].

The so-called Whickham Survey conducted in Great Britain over the period of 20 years showed that the prevalence of subclinical hypothyroidism among males at the age of 18–65 years old made 1–3 % and 6.2 % – among males above 65. Among females aged 18–65 it made 5–8 %, while among females above 65 years old – 17.4 % [3].

Data of the Framingham Heart Study (FHS) conducted in the USA (1985) in thousands of people of both sexes at the age of above 60 years revealed that 13.6 % of females and 10.3 % of males had increased level of thyrotrophin hormone (>5 mIU/L) [4]. More than 25 thousand people participated in the study conducted in the State of Colorado (USA), which showed increased level of thyrotrophin hormone at 9.5 % of people [5].

Researchers of different regions of the planet long ago revealed the relation between thyroid pathology and iodine content in the biosphere in the area of residence [6].

Osteopenia caused by the imbalance of osseogenesis and resorption thus changing the density and strength of a bone tissue is a relevant problem of stomatology since it covers a vast majority of citizens of the Russian Federation. According to the population study conducted by the Research Institute of Rheumatology of the Russian Academy of Medical Sciences, every third woman and every fourth man suffers from osteopenia. As for the population of mountain territories, there were not enough studies of thyroid pathology, in particular, of the population of the Republic of North Ossetia-Alania [7]. Considering that the Republic of North Ossetia-Alania is characterized by insufficient iodine content in its biosphere, people having this pathology constitute a socially important group, and thus there is a need to have complete understanding of their dental status and features of dental help rendered to such patients.

II. PROBLEM STATEMENT

To study the dental status of patients suffering from hypothyroidism and to carry out comparative analysis of the status of oral health and jaw osseous tissue among people under medication and people who refused from hormonal therapy.

III. MATERIALS AND METHODS

65 hospitalization records of Endocrinology Department of North Caucasian Multidisciplinary Medical Center (Beslan, Russian Federation) were considered throughout the study. 55 patients planning dental prosthodontic treatment were invited for further survey. The region of residence – Republic of North Ossetia-Alania – serves the criterion of inclusion into the study. The study covered 35 females aged from 30 to 57; and 20 males at the age of 35–54. The patients were divided into two categories: the main group of patients (receiving basic hormonal therapy) – 26 people, the control group of patients – 29 people where such therapy was not applied due to unwillingness of patients.

The specified groups were subjected to the assessment according to Greene-Vermillion index (OHI-S), Silness-Loe index (GI), CFE index and its structure. Besides, the presence of dental prostheses in oral cavity and their state, as well as orthopedic treatment needs were checked.

The osseous tissue was studied using PaX-I orthopantomograph (Vatech, South Korea) with further definition of radiological Fush index. Blood microcirculation in parodentium tissues was assessed via laser doppler flowmetry (LDF) using LAKK-M device (modification 2) (Lazma) [7].

The distinctive feature of LAKK-M is that it makes it possible to measure blood oxygenation within microcirculatory bloodstream due to additional green laser. The relative oxygen saturation index $\delta SO_2 = SO_2/M$ was recorded, where M – average perfusion. SO_2 characterizes the relation between perfusion in microcirculatory bloodstream and oxygen not consumed by tissues, i.e. this parameter is in inverse dependence on oxygen consumption by the tissue. The method of noninvasive tissue oximetry was used to analyze the dynamics of tissue saturation with oxygen.

Blood was taken to define the level of thyrotrophin TSH, T4, Ca at the clinical laboratory of North Caucasian Multidisciplinary Medical Center (Beslan, Republic of North Ossetia-Alania, Russian Federation).

The dental status was documentary recorded into a special form on the basis of the WHO dental epidemiological inspection (2013), numerical value of the Schiller-Pisarev's test (iodic number of Svrakov) was defined, roentgenograms and tomograms were analyzed to define inflammatory processes in parodentium.

Statistical data was processed using Statistica 6.0 software.

IV. RESULTS AND DISCUSSION

The following data were obtained through the analysis of hygienic indexes of oral cavity of both groups of patients.

It was noted that the patients of the main group are characterized by the reduction of OHI-S index in comparison with the control group. The corresponding indicators of the main group at the age of 30-39 years were quite low (0.6 ± 0.14), which indicates their good hygiene, in the control group this index was higher (0.8 ± 0.2).

In age category of 40-50 years this indicator has average values. The indicator of the main group (more than 1.2) is quite low, in the control group it is much higher – 1.6 ± 0.19 . The third age category of 51–57 years demonstrates the highest rates in the control group: 2.5 ± 0.32 . against 1.8 ± 0.21 in the main group (Table 1).

TABLE I. DATA OF SIMPLIFIED GREENE-VERMILLION INDEX (OHI-S).

| Age, years | Main group n=26 | Control group n=29 |
|------------|--------------------|-----------------------|
| 30–39 | 0.6 ± 0.14 | 0.8 ± 0.2 |
| 40–50 | 1.2 ± 0.16 | 1.6 ± 0.19 |
| 51–57 | 1.8 ± 0.21 | 2.5 ± 0.32 |

This is explained by not only the difference of the endocrine profile, but most likely by the social status of patients and level of their hygienic culture. The same survey confirms that the patients of the control group that refused hormonal therapy has low motivation to maintain adequate hygiene of their oral cavity.

The gingival index (GI) shows that light severity gingivitis is typical for patients of the main group in the age band of 30–39 and light and moderate severity gingivitis – patients of the control group. moderate severity was typical for patients of the control group at the age of 40-50. Besides different level of oral cavity hygiene, most likely this is explained by trophic oral musoca disorders, which are pathogenetically connected with hypothyroidism.

In particular, the loss of osseous tissue and height reduction of interproximal partition can reduce periodontal attachment or even lead to its loss, contribute to gingivitis, which is coherent with earlier obtained data [9, 10].

Heavy gingivitis is diagnosed at 5 % of patient compliance cases of the third age group (Table 2).

TABLE II. DATA OF THE GINGIVAL INDEX (GI)

| Age, years | Main group n=26 | Control group n=29 |
|------------|--------------------|-----------------------|
| 30–39 | 0.67±0.08 | 0.95±0.11 |
| 40–50 | 1.12±0.07 | 1.5±0.12 |
| 51–57 | 2.0±0.1 | 2.6±0.15 |

The dental status analysis, in particular, the CFE index showed that in the main group the CFE index was much lower in all age categories, but at the same time remained quite high. In the control group of patients who refused from adequate hormonal therapy the CFE index was very high and exceeded the indicators of the main group by 50 % and more (Table 3).

TABLE III. DATA OF CFE INDEX

| Age, years | Main group n=26 | Control group n=29 |
|------------|--------------------|-----------------------|
| 30–39 | 7.1±0.8 | 11.3±1 |
| 40–50 | 9.5±1.8 | 16.2±0.8 |
| 51–57 | 15.6±2.2 | 22.6±1.4 |

The assessment of the CFE index showed that the indicator of extracted teeth index prevails in the control group, while in the main group – sealed and carious teeth. Patients of the control group have many decay cavities of the 5th class according to Black, which is most likely caused by increased enamel demineralization. At the same time 100 % of patients of all groups need orthopedic treatment. Almost all patients of the control group need removable prosthetics, the patients the main group – mainly fixed restoration.

The laser doppler flowmetry made it possible to establish that the microcirculation indicator of the patients of the main group has low variation coefficient, which confirms high stability of microcirculatory bloodstream (Figure 1).

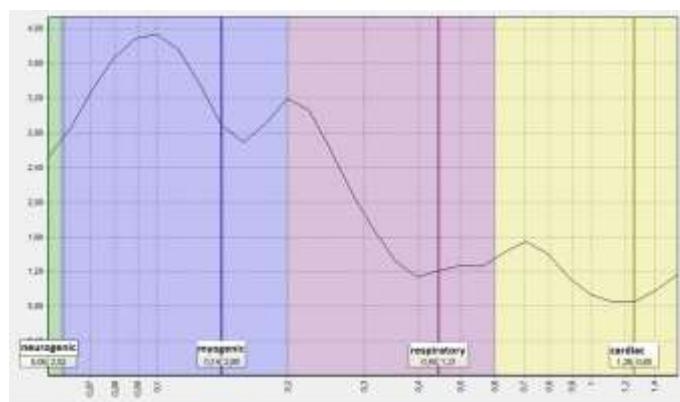


Fig. 1. Mechanisms of microcirculation regulation of patient A, 36 years old, undergoing outpatient treatment.

Adequate and coordinated contribution of active and passive regulation mechanisms of microcirculatory

bloodstream and lack of stagnant and hyperemic manifestations is noted.

In the control group of patients we clearly see the change of the influence of regulation mechanisms towards marked decline of neurogenic influence and the specific growth of passive mechanisms of regulation, which indicates the decrease of active compensatory regulation mechanisms of microcirculatory bloodstream (Figure 2).

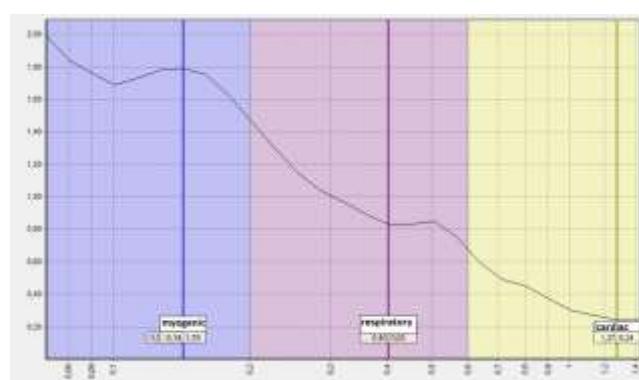


Fig. 2. Mechanisms of microcirculation regulation of patient O, 39 years old, not accepting basic hormonal therapy.

The comparison of oxygenation parameter measured via tissue oximetry we clearly defined that in the control group it considerably changes in comparison with the main group. Reduced level of oxygenation inevitably leads to dystrophy of soft tissues. In general, oxygenation parameter in the control group was 60 % lower than in the main group.

The analysis of orthopantomography images shows the resorption of osseous tissue of alveolar ridge up to 1/3 of the height of interdental partition and relatively uniform atrophy of jaws in the main group.

The patients of the control group had clear uneven reduction of osseous tissue on both jaws with the reduction of alveolar ridge height and smoothing of interalveolar septum. The resorption of osseous tissue is 1/2 heights of interalveolar septum. In certain cases, 2-3-degree mobility was noted.

Blood test interpretation defining the level of hypothyroidism – registered TSH hormone – shows the change of endocrine profile and stabilization of the TSH level and Ca in blood after a three-months treatment course in the main group. In the control group the indicators are quite diverse and fall below normal values. In particular, in the main group the average indicators on calcium concentration made 2.0–2.2 mmol/l, while in the control – from 1.5 to 2.0 mmol/l.

Thus, conditioning hormonotherapy of patients with hypothyroidism allows stabilizing the clinical picture and avoiding complications at subsequent dental treatment. Considering the fact that some patients refuse from such therapy, the role of a dentist in motivating a patient for treatment substantially increases.

V. CONCLUSION

The obtained results show that underactive thyroid gland is accompanied by the oppression of anabolic processes, which

is confirmed by the results of the blood test: increase of TSH level, decrease of T4 levels.

For patients accepting hormonal therapy the decrement of osseous tissue of an alveolar ridge is defined by 1/3 of the interdental partition height; for patients not accepting hormonal therapy the atrophy is defined by 1/2 of the interdental partition height and smoothing of interalveolar septum is observed.

Dental indexes, such as OHI-S, GI of patients not accepting hormonal therapy are highly expressed; deterioration of hygienic state increases with age.

The data of laser doppler flowmetry show the correlation of microcirculation and oxygenation depending on conducted therapy.

Thus, against the background of hypothyroidism there are essential differences in dental orthopedic treatment of patients with osteopenia subjected and not subjected to hormonal therapy. These differences strongly increase with age.

According to conclusions reached, together with endocrinologists the dental practitioners are recommended to carry out complex etiopathic and pathogenetic treatment of patients suffering from osteopenia against the background of hypothyroidism to improve the postponed results of prosthetics.

A dentist can play a significant role in early diagnostics of hypothyroidism and prevention of deterioration of general clinical symptomatology.

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