

# Risk of Periodontal Disease in Patients with Osteopenia and Osteoporosis

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**Annotation:** Based on a survey of 3150 patients over 3 years of operation of the office for the prevention and treatment of osteoporosis at a dental clinic, the risk of periodontal disease in patients with osteopenia and osteoporosis, average age  $57.6 \pm 17.3$  years, was analyzed. A significant inverse correlation between bone mineral density and periodontal index has been established.

Severe chronic periodontitis with osteoporosis is observed more often than with osteopenia and normal bone density. Its risk in patients with osteoporosis increases 5 times. The severity of periodontal damage in them is also determined by cardiovascular diseases, in most cases combined, including with type 2 diabetes mellitus.

**Keywords:** periodontal disease, osteopenia, osteoporosis  
Key words: postmenopausal osteoporosis, periodontal disease.

Chronic periodontitis is one of the most common dental diseases, the incidence of which is 81-90% of all pathological processes in the oral cavity.

Periodontitis is characterized by a complex of pathological changes, which are based on steadily progressing wave-like chronic inflammation with a transition from the gums to the lower parts of the periodontium and associated destructive processes.

With periodontitis, as a result of the spread of inflammation to the periodontium, the loose connective tissue couplings around its vessels are replaced by rigid, coarse fibrous connective tissue, the vessels lose the ability to sharply increase capacity, which leads to disruption of

periodontal hydraulics.

In the pathogenesis of the disease, the immune, nervous, tissue and humoral components play an important role with the development of vascular and cellular reactions, metabolic disorders and regulation of inflammation, as well as a decrease in the barrier function of periodontal tissue.

In recent years, the diagnosis of changes in dental patients with somatic pathology has become increasingly important.

In case of periodontal diseases, many studies have studied in detail the disturbances of regional hemodynamics (S.N. Ermolyev, 1994; A.V. Belousov, 2001). The significant significance of disturbances in regional blood circulation, microcirculation, activation and lipid peroxidation with a decrease in the antioxidant activity of the blood and disturbances has been established in the hemostasis system (L.N. Zanozdra, 1988; L.E. Leonova, 1997; M.A. Dymochka, 2002).

Today, significant importance in the pathogenesis of chronic generalized periodontitis is also attached to systemic damage to bone tissue - osteoporosis. Works by I. Wactawski-Wende et al. (1985-2008) showed a significant clinical and pathogenetic relationship between chronic periodontitis and osteoporotic changes in the peripheral skeleton (the term "peripheral" emphasizes changes in the bones of the NOT facial skeleton).

However, the known literature data, unfortunately, are still not taken into account in everyday dental practice when providing care to patients with this pathology. This is likely due to an incomplete understanding by practitioners of the pathogenetic impact of cardiovascular diseases and systemic loss of bone mineral density on changes in the periodontal complex and requires additional study.

**Objective:** To determine the risk of periodontal disease in individuals with systemic loss of bone mineral density.

### **Material and methods**

To achieve the goal and objectives of the study, we developed and put into operation an office for the prevention and treatment of osteoporosis on the basis of a multidisciplinary dental clinic.

At the Department of General Dentistry and Training of Dental Technicians, an office with an area of 16 m<sup>2</sup> was allocated, equipped with a BTX-200 densitometer (OJATEOMETI, Denmark), which allows performing two-photon absorptiometry of the distal forearm. Additionally, the office was equipped with scales and a stadiometer to determine the patient's anthropometric data (height, body weight); for dental examinations of patients, the office was equipped with a chair from KAUA.

Before the opening of the office, methodological literature was prepared for patients on the problem of osteoporosis and the relationship between osteoporosis and dental pathology. An individual patient record was developed, which included data from the patient's dental and somatic examination in the office and the necessary additional studies and consultations.

Since the BTX-200 densitometer is a device for screening osteoporosis, if necessary, patients were sent to densitometer.

riya of the central skeleton to the city office for the prevention and treatment of osteoporosis of the Moscow Department of Health on the basis of the outpatient department of City Clinical Hospital No. 81, the quota was 30 patients per month. When indicated, bone remodeling markers were examined in the certified Vera laboratory.

If there were indications, patients were additionally advised by staff from the Department of Clinical Pharmacology, Pharmacotherapy and Emergency Medicine of Moscow State Medical University.

Over the 3 years of operation of the office in the treatment and preventive dental center, 3150

patients were examined, 1037 men and 2113 women. The average age was  $57.6 \pm 17.3$  years. Additional demographic characteristics of patients are presented in Table. 1.

Based on patient complaints, clinical examination, and examination by a therapist, somatic pathology was diagnosed in 98% of patients.

All patients underwent a standard dental examination: anamnesis, external examination, instrumental examination of the oral cavity, the prevalence and intensity of dental caries according to the KPU index (the number of carious, filled and extracted teeth); frequency and structure of non-carious lesions of hard dental tissues;

structure of lesions of the oral mucosa; hygienic condition of the oral cavity according to the method of Green, Vermilion IGR-U; periodontal index - PI (A. Russell, 1956); periodontal index CPITN, gum bleeding index (PBI, Muhlemann H.P., 1971); papillary-marginal-alveolar index (PMA, Parma C., 1960).

Additional methods of dental examination included computer radiovisiography using a Trofy device (France) and ortho-pantomography.

Table 1

#### Patient demographics

Characteristic n%

Male gender 1037 32.9

women 2113 67.1

Average age, male years  $55.4 \pm 6.2$

women  $56.3 \pm 5.5$

Working persons 1557 49

Persons under 30 years old 127 4.1

Persons over 50 years old 859 27.3

Persons with disabilities 607 19.3

The analytical part of the work consisted of several stages.

First, we analyzed the prevalence of osteoporosis and chronic periodontitis, including in terms of age.

Next, we calculated the relative risk of chronic periodontitis in individuals with loss of bone mineral density and the relative risk of severe chronic periodontitis in patients with varying degrees of this loss.

Then, correlation studies were carried out on the severity of damage to the periodontal complex and the degree of bone density loss.

Based on the data obtained, it was stated that there was no significant correlation between bone density and the severity of the pathology of the periodontal complex, which was the reason for further analysis.

We determined the influence of somatic diseases on the severity of periodontal damage.

Risk calculations were carried out according to generally accepted methods. The relationship was assessed using the method of correlation statistics, the reliability of the relationship was determined at  $p < 0.05$ . Average values and standard deviations were also calculated.

#### Results and discussion

In most of the patients examined, risk factors for osteoporosis were quite common. Thus, an

atraumatic fracture was diagnosed in 18% of patients; a decrease in height by more than 3 cm (as a manifestation of compression of the vertebral bodies) was noted in 30.8% of cases.

Hypogonadism was found in 54.4% of patients, bad habits (smoking and chronic alcoholism) in 40.6%. Bone fractures in blood relatives were observed in 19% of patients.

77.49% of the examined patients had low bone density,

% sextants

% of patients

In patients with osteoporosis, the age was significantly higher compared to patients without loss of bone density, 66.4 and 51.8 years, respectively.

It should be noted that the frequency of pathology of the periodontal complex increases with increasing loss of bone density. Thus, pathological changes in the periodontium were detected in 100% of patients with osteoporosis, while in patients without loss of bone density - in 80.1% of cases. We further found that as bone density increases, a more severe course of periodontal disease is observed. In general (in all patients), an analysis of the dental status allowed us to establish a reliable relationship between the loss of bone density and the degree of periodontal damage

Thus, patients with loss of bone density are significantly more likely to experience pathological changes in the periodontal complex. The severity of periodontal disease is significantly related to the degree of systemic loss of bone density.

However, the increase in the latter is directly dependent on age, as is periodontal damage. This determined the strategic question for further analytical research: what determines the increasing severity of periodontal pathology to a greater extent: age or systemic loss of bone density?

We took the age of the patients as the basis for the analysis and analyzed the degree of periodontal damage (2 indicators - the depth of periodontal pockets and the periodontal index) depending on the degree of bone density loss. We could not distinguish between osteopenia and osteoporosis subgroups because the analysis focused on patients under 30 years of age, when low bone density values are possible, and not osteoporosis.

We established significant differences in both the depth of periodontal pockets and the periodontal index in different age groups (Fig. 4, 5). However, more important are the significant differences in these indicators within age groups. This overall confirms that decreased bone density, like age, is a risk factor for periodontal disease.

Another confirmation of this fact can be the dependence of the severity of chronic periodontitis on the degree of loss of bone density. In patients with osteoporosis, severe generalized periodontitis was present in 47.1% of cases; in patients with osteopenia - in 34.2%; in patients with normal bone density - in 18.79% ( $p < 0.05$ ).

Calculation of the relative risk of periodontitis of varying severity within the subgroups: normal PC - osteopenia - osteoporosis showed a significant increase in the risk of more severe periodontal damage with increasing loss of bone density (Fig. 6).

Thus, if we take the risk of periodontal damage in patients with normal bone density as 0, then the risk of moderate periodontitis with osteopenia increases by 1.2, and severe periodontitis by 3.2 ( $p < 0.05$ ).

In patients with osteoporosis: the risk of severe periodontitis is increased by 4.96 times ( $p < 0.01$ ), moderate - by 0.9 times ( $p < 0.05$ ). At the same time, the risk of mild periodontitis is less than in patients with normal bone density - this also indicates the reliability of the data obtained, since the incidence of mild periodontitis in individuals with normal bone density is 74.1%, and in osteoporosis - 18.79 %.

Overall, the relative risk of periodontal disease in patients with loss of bone density is increased

by 20.6% ( $p < 0.05$ ) compared to patients without it (meaning all periodontal diseases).

However, by conducting an analytical study of all patients, we identified a significant correlation between the severity of periodontal damage (depth of periodontal pockets and periodontal index) and bone mineral density.

A separate analysis of the subgroup of patients with osteoporosis did not show a significant correlation. Therefore, in the presence of osteoporosis, the increase in the severity of periodontal disease does not depend on further loss of density. We decided to analyze additional factors influencing the severity of periodontal pathology. Most of our patients had somatic diseases, often combined pathology, and more than two diseases. The main thing is that we have established a reliable influence of somatic diseases on the severity of periodontal damage. The depth of periodontal pockets was chosen as a constant, and the correlation was assessed by the number of nosological units,  $r = 0.3$ ,  $p < 0.05$ .

Table 2 Frequency of periodontitis in osteopenia and osteoporosis in persons with cardiovascular diseases

Notes \* — Chronic generalized periodontitis (s + t) of moderate and severe degree. \*\* —  $p < 0.05$  compared with patients without loss of bone density.

Next, having identified the most common somatic pathology, we conducted a multivariate analysis of its effect on the severity of periodontal damage (the constant is the depth of periodontal pockets).

The most significant diseases in increasing the severity of periodontal damage were established ( $p < 0.05$ ): IHD (angina pectoris and/or post-infarction cardiosclerosis) -  $p = 0.03$ ; IHD in combination with arterial hypertension -  $p = 0.03$ ; combination of hypertension, coronary artery disease, type 2 diabetes mellitus -  $p = 0.01$ ; as well as chronic diseases of the gastrointestinal tract. For other nosological units, reliability has not been established.

Having identified for analysis two subgroups of patients with cardiovascular diseases and those with type 2 diabetes mellitus, we tested the effect of loss of bone density on the condition of the periodontal complex.

First, we found that in these subgroups there were significantly more patients with loss of bone density, and they had significantly more severe periodontal damage (Table 2).

Thus, the study established a significant effect of systemic loss of bone density on the severity of periodontal damage. Moreover, the risk of severe periodontitis increases almost 5 times in individuals with osteoporosis compared to that in individuals with normal bone density.

At the same time, the presence of vascular pathology, as well as its combination with type 2 diabetes mellitus, introduces a significant additional risk into the severity of damage to the periodontal complex, which generally indicates a significant increase in the risk of significant periodontal damage in individuals with these somatic diseases and loss of bone density.

## Conclusions

1. Over 3 years of operation of the office for the prevention and treatment of osteoporosis at a multidisciplinary dental clinic, 3150 patients were examined, 77.49% of them had low bone density, and every 5th had osteoporosis. At the same time, pathological changes in periodontal

Nosology Bone mineral density Number of patients P1 Number of patients with CGP (s + t)\*

Cardiovascular diseases, n = 1348 Normal Reduced 387,961 3.9 5.3 157,529\*\*

Cardiovascular diseases and diabetes mellitus type 2, n = 537 Normal Reduced 76,461 4.1 6.5 97,322\*\*

tal complex were observed in more than 95% of patients with low bone density.

2. A significant inverse correlation has been established between bone density and the periodontal

index, and in comparison with patients with osteopenia and normal bone density, severe chronic periodontitis is more often observed in osteoporosis.

3. The periodontal index and the depth of periodontal pockets in patients with chronic periodontitis increase with age, but in a certain age group these indicators are higher in patients with osteoporosis.

4. Systemic loss of bone mineral density increases the risk of chronic periodontitis by more than 20%. And the risk of severe chronic periodontitis among all patients with periodontal pathology increases almost 5 times in patients with osteoporosis.

5. In patients with osteoporosis, the severity of periodontal damage is determined by the presence of cardiovascular diseases, in most cases combined, including type 2 diabetes.

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