American Journal of Medicine and Medical Sciences 2025, 15(12): 4591-4593
DOI: 10.5923/j.ajmms.20251512.86

Effect of Generalized Osteoporosis on Stomatological Status

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Abstract Osteoporosis is a systemic skeletal disease characterized by a decrease in bone mass and a disruption of bone microarchitektonics, leading to increased bone fragility and an increased risk of fractures. According to the World Health Organization, osteoporosis is one of the most serious public health problems affecting more than 200 million people worldwide, primarily women in the postmenopausal period.

Keywords Osteoporosis, Bone density, Alveolar bone, Periodontitis, Dental implantation, Jaw osteonecrosis, Bisphosphonates, Menopause, Dental status, Jaw bones, Bone resorption, Bone mineral density, Orthopantomography, Computed tomography

1. Introduction

The structure and chemical composition of the bone tissue of the jaws are generally similar to the bones of the skeleton. However, the peculiarity of the alveolar process is the high intensity of remodeling processes [1,9]. In a healthy state, the height of the alveolar ridge is maintained due to the balance between bone formation and absorption, which is controlled by both general (systemic) and local (local) regulatory factors [2,10]. When the functional load changes, the dentoalveolar apparatus quickly adapts: the loaded trabeculae become denser, and when the load decreases, they undergo resorption (Wolf's law). Even with calcium deficiency, adequate chewing exertion can partially compensate for bone loss, while hypodynamia and lack of stimulation lead to progressive atrophy [3,11].

At the same time, the question of whether periodontitis is an independent risk factor for osteopenic changes in the jaws or is it primarily associated with systemic osteoporosis remains debatable. Most likely, both mechanisms interact and potentiate each other [4,12].

In recent decades, special attention has been paid to studying the relationship between systemic osteoporosis and the condition of the alveolar bone of the jaws. Analysis of clinical and experimental data showed that a decrease in the mineral density of the body's bone tissue is generally accompanied by progressive resorption of the alveolar ridge, which can be a predisposing factor for tooth loss and the development of periodontal diseases [5,13].

Studies by domestic authors confirm that in women in the postmenopausal period, bone mass decrease correlates with a decrease in the height of the alveolar ridge and interdental septa, as well as gingival recession. This allows us to consider osteoporosis as a risk factor for periodontal diseases, regardless of local inflammatory processes [6,14].

The experience of the Samarkand Dental School demonstrates that therapeutic approaches aimed at improving bone mineral density (including the use of preparations such as Forcal Plus and the anti-resorptive agent Alendra) benefit periodontal tissues. In particular, they contribute to the slowing down of the alveolar bone resorption process [7,15].

Some researchers indicate that the relationship between systemic osteoporosis and tooth loss is not always linear, as the condition of the dentoalveolar system is influenced by many factors: hygiene level, inflammatory diseases of the periodontium, and concomitant somatic pathology. Nevertheless, most data indicate that systemic osteoporosis creates a background where local factors have a more aggressive effect on periodontal tissue [8,16].

Purpose of the study: to study the influence of generalized osteoporosis on the condition of periodontal tissues,

Received: Nov. 12, 2025; Accepted: Dec. 8, 2025; Published: Dec. 25, 2025
Published online at http://journal.sapub.org/ajmms

alveolar processes of the jaws, and the overall dental status, as well as to develop recommendations for optimizing dental care for patients with this pathology.

2. Materials and Methods of Research

The study included 180 patients aged 45 to 75 years, divided into two groups: the main group (n=120): patients with a diagnosis of generalized osteoporosis and the control group (n=60): patients without osteoporosis, comparable in age and gender. Statistical processing of the results was carried out using the SPSS 26.0 software package. Descriptive statistics methods, Pearson's correlation analysis, Student's t-test for independent samples, and Pearson's $\chi 2$ criterion were used. The critical significance level was taken as $p<0.05$.

3. Research Results

The average age of patients in the main group was 62.4±8.7 years, in the control group - 59.8±7.3 years ($p>0.05$). In the main group, women predominated (87.5%), which corresponds to epidemiological data on osteoporosis. The average duration of the postmenopausal period in women of the main group was 14.2±6.8 years. In patients with osteoporosis, statistically significant differences in the condition of the periodontium were revealed compared to the control group:

- OHI-S hygiene index: 2.8±0.6 vs. 1.9±0.4 ($p<0.001$)
- RMA Index: 68.4±12.3% vs. 32.7±8.9% ($p<0.001$)
- Periodontal PI index: 3.2±0.8 vs. 1.4±0.5 ($p<0.001$)
- Average depth of periodontal pockets: 4.7±1.2 mm vs. 2.8±0.6 mm ($p<0.001$).

Pathological tooth mobility of the I-II degree was detected in 78.3% of patients in the main group versus 23.3% in the control group ($p<0.001$).

Morphometric analysis of orthopantomograms showed that the height of the mandibular alveolar ridge in the maxillary region in patients with osteoporosis was 18.6% lower compared to the control group ($p<0.001$), the cortical index of the mandible: normal picture was noted in 15.8% of patients in the main group versus 71.7% in the control group, and signs of alveolar ridge resorption were detected in 89.2% of patients with osteoporosis. Significant negative correlations were established between: bone mineral density (BMP) and the depth of periodontal pockets ($r=-0.67$; $p<0.001$), BMP and the RMA index ($r=-0.58$; $p<0.001$), and BMP and the height of the alveolar processes ($r=0.72$; $p<0.001$). In 68 patients (56.7%) of the main group receiving bisphosphonates, the following features were noted, such as delayed healing of cavities after tooth extraction in 23.5% of patients, two cases (2.9%) of jaw osteonecrosis, and the need to correct the dental treatment plan in 89.7% of patients. In the periodontal pockets of patients with osteoporosis, an increased content of Porphyromonas gingivalis was detected by 2.3 times ($p<0.001$). Increase in the number of Tannerella forsythia by 1.8 times ($p<0.01$). Microbial imbalance with predominance of pathogenic flora.

4. Conclusions

Generalized osteoporosis has a significant negative impact on dental status, manifesting as deterioration of periodontal tissues, resorption of the alveolar processes of the jaws, and increased tooth mobility. A direct correlation has been established between the degree of bone mineral density decrease and the severity of periodontal disorders, which confirms the systemic nature of osteoporotic changes in the maxillofacial region. In patients with osteoporosis, a more severe course of inflammatory diseases of the periodontium is noted with the formation of deep periodontal pockets, a pronounced inflammatory reaction, and a disruption of the oral microbiocenosis. Antiresorptive therapy with bisphosphonates requires a special approach to planning dental treatment due to the risk of developing jaw osteonecrosis and impaired bone healing processes. Radiological changes in the alveolar processes of the jaws can serve as an additional diagnostic criterion in the screening of osteoporosis, especially in postmenopausal women. It is necessary to implement an interdisciplinary approach to managing patients with osteoporosis, including close cooperation between dentists, endocrinologists, and rheumatologists to optimize treatment and preventive measures. The developed algorithm for dental examination of patients with osteoporosis allows for the timely detection and correction of disorders in the maxillofacial region, which contributes to improving the quality of life of this category of patients. Preventive measures aimed at maintaining oral hygiene and timely treatment of periodontal diseases are of particular importance in patients with osteoporosis to prevent the progression of pathological changes in the alveolar bone.

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