Abstract

Calcium and its compounds play an important role in the regulation of many functions of the body. The concentration of calcium ions in the serum is one of the important constants of homeostasis.

The objective of the research was to study the level of total calcium, ionized calcium, and phosphorus in patients with stage II hypertension and generalized periodontitis of II degree of severity, depending on the method of treatment.

Materials and methods. The main group consisted of 70 patients with generalized periodontitis of II degree of severity and stage II hypertension who were divided into 4 groups. The comparison group consisted of 30 patients suffering from generalized periodontitis of II degree of severity without hypertension who were divided into similar 4 groups depending on age and type of treatment. The control group included 17 patients of corresponding age with healthy periodontium and without somatic pathology.

Results. Twelve months after starting treatment, in younger patients of the main group receiving basic therapy, serum phosphorus level increased by 0.03 mmol/l, and in the older ones, it increased by 0.04 mmol/l. In younger and older patients of the comparison group, serum phosphorus level increased by 0.05 mmol/l. The patients who received basic therapy in combination with the proposed scheme of treatment had higher level of phosphorus than those who received basic therapy only. Twelve months after starting treatment, serum level of total calcium decreased in young and older patients of the main group and comparison group receiving basic therapy. An obvious improvement of treatment 12 months after its starting was observed in all the patients of the main group and comparison group who received basic therapy in combination with the proposed scheme of treatment.

Conclusions. The improved treatment scheme was more effective for treatment of generalized periodontitis of II degree of severity in patients with stage II hypertension.

Keywords
hypertension; generalized periodontitis; Ca

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Problem statement and analysis of the latest research

Calcium and its compounds play an important role in the regulation of many functions of the body [2, 3, 5, 9, 12, ?]. About 99% of calcium is found in bone and cartilage tissues in the form of hydroxyapatite crystals (the main depot of calcium in the body), the rest - in soft tissues and extracellular fluid [1, 15]. The concentration of calcium ions in the serum is one of the important constants of homeostasis [10, 13, 14]. Phosphorus metabolism is closely related to calcium metabolism. The total amount of phosphorus is in the bone tissue in the form of crystals of hydroxyapatite. Adequate concentration of phosphorus in the blood is necessary for normal mineralization [2, 3, 6, 7, 9, 11, 12, 13].

The cellular composition of the bone is represented by osteoblasts, osteocytes and osteoclasts. The main function of osteoclasts is the resorption of the bone matrix [8, 16]. It has been proved that the activation of osteoclasts is influenced by tumor necrosis factor alpha, interleukin-1, interleukin-6. The structural integrity of the skeleton is supported by a continuous process of bone remodeling. Bone remodeling begins in the womb and lasts during a lifetime of a person [4, 15].

Bone tissue remodeling plays a key role in bone homeostasis and metabolic processes in the body. It is a permanent physiological process, the main function of which is the renovation of bone structures, adaptation to mechanical loads, and the maintenance of mineral metabolism of calcium and phosphorus [7]. The process of remodeling is controlled by hormones, a number of local biologically active substances that are represented by polypeptide growth factors and cytokines.

Bone tissue is a depot of calcium and at the same time, calcium determines the strength of the bones, carrying out a structural function. After 40 years of age, the process of
resorption begins to prevail over bone formation, which leads to a gradual decrease in the mass and strength of the bone.

In the development of the dystrophic inflammatory process, vascular disorders play an essential role. Clinical and epidemiological studies using pathomorphological methods showed significant changes in the vascular wall of the periodontal artery, especially the interdental artery. Optimal conditions were created to increase the pathogenicity of the microflora of periodontal pockets, and the activity of enzymes changed. The unidirectional distribution of atherosclerosis, hypertensive disease and periodontal disease in people over 40 years old has been proved [1].

The objective of the research was to study the level of total calcium, ionized calcium, and phosphorus in patients with stage II hypertension and generalized periodontitis of II degree of severity, depending on the method of treatment.

1. Materials and Methods

The main group (MG) consisted of 70 patients with generalized periodontitis of II degree of severity and stage II hypertension, who were divided into 4 groups: Group I included 13 patients at the age of 35-44 years (younger group) receiving basic therapy (BT); Group II included 21 patients at the age of 45-54 years (older group) who received BT; Group III consisted of 17 patients at the age of 35-44 years and Group IV comprised 19 patients at the age of 45-54 years, who received treatment according to the scheme we proposed.

The comparison group (CG) consisted of 30 patients suffering from generalized periodontitis of II degree of severity without hypertension who were divided into similar 4 groups depending on age and type of treatment: Group V included 5 patients at the age of 35-44 years and Group VI comprised 10 patients at the age of 45-54 years – they received BT; Group VII and Group VIII, consisted of 5 patients at the age of 35-44 years and 10 patients at the age of 45-54 years, respectively, who received treatment according to the proposed scheme.

BT included the following measures: oral irrigation with solutions of antiseptic agents (0.1% solution of chlorhexidine bichlorurate), removal of soft plaque, ultrasonic removal of dental plaque, usage of Metrogyl-denta gel. Our scheme included the following treatment: BT and the inclusion of Ca-D3 NICOMED at a dose of 2 tablets per day (in the morning and evening for 12 months); 10 sessions of electrophoresis with “Calcium Gluconate”; 1 tablet of Pentoxifylline 3 times a day for 30 days (the drug was prescribed in courses: once in three months - 4 courses per year).

The control group included 17 patients of corresponding age with healthy periodontium and without somatic pathology.

The diagnosis of periodontal diseases was made on the basis of the anamnesis, clinical dental examination and data of generally accepted additional methods of examination. When making diagnosis of periodontal disease, the classification of Danilevsky MF (1994) was used.

The obtained results were statistically processed using statistical package Stat Soft 6.0, traditional methods of vari-

ation statistics applying averages and the estimation of their statistical significance.

2. Results and Discussion

Twelve months after starting treatment, in younger patients of the MG receiving BT, serum phosphorus level increased by 0.03 mmol/l, and in the older ones, it increased by 0.04 mmol/l. In younger and older patients of the CG, serum phosphorus level increased by 0.05 mmol/l. The patients who received BT in combination with the proposed scheme of treatment had higher level of phosphorus than those who received BT only (Table 1).

In the MG, the level of phosphorus increased by 0.10 mmol/l in younger patients, and by 0.11 mmol/l in older patients. In the CG, the level of phosphorus increased by 0.11 mmol/l in younger patients, and by 0.12 mmol/l in older ones.

In younger and older patients of the MG who received BT, the level of total calcium was significantly lower in comparison with patients of the CG (p<0.001). The same trend was observed in groups receiving BT in combination with the proposed treatment scheme (p<0.001).

Twelve months after starting treatment, serum level of total calcium decreased in young and older patients of the MG and CG receiving BT (Table 2).

The level of total calcium increased in patients of all age groups (who received BT in combination with the proposed scheme of treatment). In younger patients of the MG, the level of total calcium increased by 16%, and in older patients, it increased by 14%; in the CG, this indicator increased by 13.7% and 15.4%, respectively.

In younger patients of the MG, who received BT, the level of total calcium in the serum was significantly lower in comparison with the patients of the same group, who received the treatment according to the proposed scheme (p<0.001).

When comparing the results obtained after treatment in patients suffering from generalized periodontitis with hypertension and without it, we found that patients with hypertension had lower level of the total calcium in the serum.

Twelve months after starting treatment, in patients of the MG who received BT, the level of ionized calcium in the serum decreased in both age groups (Table 3).

An obvious improvement of treatment 12 months after its starting was observed in all the patients of the MG and CG who received BT in combination with the proposed scheme of treatment.

Twelve months after starting treatment, in younger and older patients of the MG, who received treatment according to the improved scheme, an improvement by 22.9% and 17.1%, respectively, was observed. In patients of the CG, the level of ionized calcium increased by 44.44% and 40.5%, respectively.

In younger and older patients of the MG who received BT, the level of ionized calcium was significantly lower in comparison with patients of the CG (p<0.001; p<0.01). In younger patients of the CG, the level of ionized calcium was
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**Table 1.** Dynamics of changes in the level of phosphorus in patients during different observation periods

<table>
<thead>
<tr>
<th>Groups</th>
<th>MG 1 (n=13)</th>
<th>2 (n=21)</th>
<th>3 (n=17)</th>
<th>4 (n=19)</th>
<th>CG 5 (n=5)</th>
<th>6 (n=10)</th>
<th>7 (n=5)</th>
<th>8 (n=10)</th>
<th>Control group 9 (n=17)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before treatment</td>
<td>0.61±0.03</td>
<td>0.54±0.01</td>
<td>0.67±0.04</td>
<td>0.55±0.02</td>
<td>0.70±0.01</td>
<td>0.68±0.02</td>
<td>0.71±0.02</td>
<td>0.66±0.02</td>
<td>1.14±0.05</td>
</tr>
<tr>
<td></td>
<td>p&lt;0.001</td>
<td>p&lt;0.001</td>
<td>p&lt;0.001</td>
<td>p&lt;0.001</td>
<td>p&lt;0.001</td>
<td>p&lt;0.001</td>
<td>p&lt;0.001</td>
<td>p&lt;0.001</td>
<td>1.14±0.05</td>
</tr>
<tr>
<td>12 months after treatment</td>
<td>0.64±0.02</td>
<td>0.58±0.01</td>
<td>0.77±0.03</td>
<td>0.66±0.02</td>
<td>0.75±0.01</td>
<td>0.73±0.01</td>
<td>0.82±0.02</td>
<td>0.78±0.01</td>
<td>1.17±0.04</td>
</tr>
<tr>
<td></td>
<td>p&lt;0.001</td>
<td>p&lt;0.001</td>
<td>p&lt;0.001</td>
<td>p&lt;0.001</td>
<td>p&lt;0.001</td>
<td>p&lt;0.001</td>
<td>p&lt;0.001</td>
<td>p&lt;0.001</td>
<td>1.17±0.04</td>
</tr>
</tbody>
</table>

*Note:* a significant difference between the indicators in healthy and ill individuals, p<0.001

**Table 2.** Indicators of total calcium in patients before and after treatment

<table>
<thead>
<tr>
<th>Groups</th>
<th>MG 1 (n=13)</th>
<th>2 (n=21)</th>
<th>3 (n=17)</th>
<th>4 (n=19)</th>
<th>CG 5 (n=5)</th>
<th>6 (n=10)</th>
<th>7 (n=5)</th>
<th>8 (n=10)</th>
<th>Control group 9 (n=17)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before treatment</td>
<td>1.81±0.03</td>
<td>1.74±0.02</td>
<td>1.78±0.04</td>
<td>1.71±0.02</td>
<td>1.90±0.03</td>
<td>1.83±0.01</td>
<td>1.90±0.03</td>
<td>1.82±0.02</td>
<td>2.34±0.03</td>
</tr>
<tr>
<td></td>
<td>p&lt;0.001</td>
<td>p&lt;0.001</td>
<td>p&lt;0.001</td>
<td>p&lt;0.001</td>
<td>p&lt;0.001</td>
<td>p&lt;0.001</td>
<td>p&lt;0.001</td>
<td>p&lt;0.001</td>
<td>2.34±0.03</td>
</tr>
<tr>
<td>12 months after treatment</td>
<td>1.78±0.03</td>
<td>1.70±0.02</td>
<td>2.07±0.03</td>
<td>1.95±0.02</td>
<td>1.87±0.03</td>
<td>1.83±0.01</td>
<td>2.16±0.03</td>
<td>2.10±0.02</td>
<td>2.35±0.02</td>
</tr>
<tr>
<td></td>
<td>p&lt;0.001</td>
<td>p&lt;0.001</td>
<td>p&lt;0.001</td>
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<td>p&lt;0.001</td>
<td>p&lt;0.001</td>
<td>p&lt;0.001</td>
<td>p&lt;0.001</td>
<td>2.35±0.02</td>
</tr>
</tbody>
</table>

*Note:* a significant difference between the indicators in healthy and ill individuals, p<0.001

1.35 times higher than that in patients of the MG; in older patients, this indicator was 1.3 times higher.

Among younger and older patients, who were treated according to BT in combination with the proposed scheme, the level of ionized calcium was significantly lower in patients of the MG as compared to patients of the CG (p<0.001). In older patients of the MG, the level of ionized calcium was 1.44 times lower than in patients of the CG and in younger patients of the MG, the level of ionized calcium was 1.51 times lower than in patients of the CG.

The data obtained in the course of our research correlate with the existing researches. The levels of total and ionized calcium, serum phosphorus obtained before and during treatment are the same as obtained by Hubina N.V. (2009) and Kutynska I.P. (2011). The data obtained correlate with the data obtained by Dovhanych O.V. (2015).
Table 3. Dynamics of changes in the level of ionized calcium in the serum of patients before and after treatment

<table>
<thead>
<tr>
<th>Groups</th>
<th>MG (n=13)</th>
<th>2 (n=21)</th>
<th>3 (n=17)</th>
<th>4 (n=19)</th>
<th>5 (n=5)</th>
<th>6 (n=10)</th>
<th>7 (n=5)</th>
<th>8 (n=10)</th>
<th>Control group 9 (n=17)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before treatment</td>
<td>0.36±0.01</td>
<td>p&lt;0.001</td>
<td>p&lt;0.001</td>
<td>p&lt;0.001</td>
<td>0.35±0.01</td>
<td>0.45±0.01</td>
<td>0.43±0.01</td>
<td>0.45±0.01</td>
<td>0.42±0.01</td>
</tr>
<tr>
<td></td>
<td>0.36±0.01</td>
<td>p&lt;0.001</td>
<td>p&lt;0.001</td>
<td>p&lt;0.001</td>
<td>0.35±0.01</td>
<td>0.45±0.01</td>
<td>0.43±0.01</td>
<td>0.45±0.01</td>
<td>0.42±0.01</td>
</tr>
<tr>
<td></td>
<td>p&lt;0.001</td>
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<td>p&lt;0.001</td>
<td>p&lt;0.001</td>
<td>p&lt;0.001</td>
<td>p&lt;0.001</td>
</tr>
<tr>
<td>12 months after treatment</td>
<td>0.34±0.03</td>
<td>0.34±0.03</td>
<td>0.34±0.03</td>
<td>0.34±0.03</td>
<td>0.43±0.01</td>
<td>0.46±0.01</td>
<td>0.45±0.01</td>
<td>0.65±0.03</td>
<td>0.59±0.01</td>
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<tr>
<td></td>
<td>p&lt;0.001</td>
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<td>p&lt;0.001</td>
<td>p&lt;0.001</td>
<td>p&lt;0.001</td>
<td>p&lt;0.001</td>
<td>p&lt;0.001</td>
<td>p&lt;0.001</td>
</tr>
</tbody>
</table>

Note: a significant difference between the indicators in healthy and ill individuals, p<0.001

3. Conclusions

1. After treatment, in patients with generalized periodontitis who did not suffer from hypertension, the level of total calcium and ionized calcium was higher as compared to patients suffering from hypertension and generalized periodontitis.

2. The improved treatment scheme was more effective for treatment of generalized periodontitis of II degree of severity in patients with stage II hypertension.

References


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