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Studies of the State of Metabolism of Skeletal Bone Tissue and the Intensity of Remodeling in the Blood Plasma by Determining the Level of Total Calcium and Phosphorus in the Blood

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Annotation: This article presents the results of a study of the state of metabolism of skeletal bone tissue and the intensity of remodeling in the blood plasma by determining the level of total calcium and phosphorus in the blood.

Thus, thanks to a comparative assessment of treatment methods, it can be noted that the “one two three” complex is more effective in restoring the components of mineral metabolism in the blood, helps maintain the required level of calcium and phosphorus in the blood

Keywords: Osseointegration, postmenopausal osteoporosis, dental implants.

Relevance: Research in the field of osseointegration of implants includes the search for optimal implantation technologies, including modification of the surface of implants and the development of new surgical methods. In addition, emphasis is placed on studying the effects on osseointegration processes at a deeper level, such as cellular and tissue. This allows us to more fully and deeply understand the processes occurring during the integration of implants with biological tissues, and to develop more effective methods of treatment and rehabilitation.

The purpose of the study: Is to improve the results of prosthetics with fixed structures supported by dental implants in patients with postmenopausal osteoporosis.

Object of the study: To solve the problems and achieve the goal of the study, the results of examination and treatment of 90 female patients of menopausal age from 45 to 65 years (±51.6 years) who sought orthopedic dental care were taken. This contingent of patients with partial secondary adentia, requiring orthopedic treatment based on dental implants, were divided into the following groups

The main (I) group consisted of 30 menopausal women suffering from postmenopausal osteoporosis, who were fitted with ALPHA DENT Superior Active dental implants (Germany) in a buffer solution with a hydrophilic SLA-Active surface.

The comparison group (II) consisted of 30 menopausal women suffering from postmenopausal osteoporosis who received ALPHA DENT Active dental implants with a 3D-Active hydrophilic surface.

Both groups were divided into subgroups depending on the treatment method:

A-subgroup of patients receiving traditional treatment with prosthetics supported by dental implants

B-subgroup of patients receiving special treatment for prosthetics supported by dental implants, taking a vitamin-mineral complex consisting of three drugs that are administered at three main stages of implantation: preparing the bone for implantation - Pre Implantation Complex Alpha (powder for oral solution), healing - Fast integration Complex Alpha. (capsules), and, osseointegration - Post integration Complex Alpha (capsules).

The control group consisted of 30 patients with intact dentition or dentition restored with a fixed structure, without a history of mineral metabolism disorders, cardiovascular or endocrine diseases.

In order to characterize the metabolic state of skeletal bone tissue and the intensity of remodeling, we studied the levels of total calcium and phosphorus in the blood plasma.

Table 1. Values of the studied indicators of mineral metabolism and markers of bone remodeling in the blood, obtained before the start of taking the complex of drugs and before dental implantation.

Patient groups	I	II	Control
Calcium mmol/ml	1,89	1,96	2,36
phosphorus mmol/ml	0,79	0,84	1,13

When studying data regarding mineral metabolism, a decrease in calcium and phosphorus levels in the blood was noted in postmenopausal patients suffering from osteoporosis. Thus, in patients of group 1, the average calcium level in the blood was 1.89 mmol/ml, and in group 2 - 1.96 mmol/ml, which is 13.6% and 16.9%, respectively, lower than the average, obtained in the control group. The level of inorganic phosphorus determined in the blood serum also had relatively reduced values - by 15.9% in patients of group I and 25.7% in patients of group II, relative to the control group, in which the average serum phosphorus was 1.13 mmol/ml .

In order to comparatively evaluate the effectiveness of our proposed treatment, groups I and II of patients with postmenopausal osteoporosis were divided into subgroups with an equal number of subjects, depending on the treatment method (randomized controlled method):

A-subgroup of patients receiving traditional treatment with prosthetics supported by dental implants.

B-subgroup of patients receiving special treatment for prosthetics supported by dental implants, taking a vitamin-mineral complex consisting of three drugs that are administered at three main stages of implantation: preparing the bone for implantation - Pre Implantation Complex Alpha (powder for oral solution, No. 3), the healing period - Fast integration Complex Alpha (capsules, No. 10), and the period of osseointegration - Post integration Complex Alpha (capsules, No. 10)

A month after the start of taking the drugs, the results of the study of patients, depending on the treatment method, were as follows.

Table 1. Values of the studied indicators of mineral metabolism and markers of bone remodeling in the blood, obtained one month after the start of taking the complex of drugs and dental implantation.

Patient groups	I		II		Control
	А	Б	А	Б	
Calcium	1,91	2,03	2,01	2,14	2,12-2,60
Phosphorus	0,80	0,83	0,88	0,70	1,15

Thus, in patients of group I with bone categories A and B, the average value of serum calcium level increased by 7.41% in subgroup B; in patients of subgroup A, no significant deviations were observed compared to the initial data. Regarding this indicator, in patients of group II with bone category C, as well as in patients of group I, in the subgroup with the traditional method of treatment, minor changes were noted towards an increase in the indicator, however, it is worth noting that, in addition, the average value of the serum calcium in the blood of patients of the subgroup taking the proposed complex of drugs increased by 9.2%, compared with the initial data obtained in the basic study of group II patients, also after treatment, the values of the indicator were close to those in patients in the control group.

When studying the indicators of inorganic phosphorus in the blood, the following principle of changes was observed. Thus, in patients of both groups, subgroups with traditional treatment with an initially reduced level of phosphorus, no significant changes were found after treatment: in subgroup A (I), the level of phosphate in the blood increased by 1.2%, and in subgroup A (II) – by 4.7%. At the same time,

an increase in serum calcium in patients of group II B subgroup, after treatment with the “one two three” complex, was accompanied by a decrease in the level of phosphate to 0.70 mmol/l (16.6%).

Thus, in patients with an initially close to normal calcium level and receiving traditional treatment, the phosphorus level did not change, but in patients with an initially low level and taking the complex of drugs we proposed, it decreased. Thus, the “one two three” complex contributed to the improvement of calcium-phosphorus metabolism in patients with a reduced level of serum calcium in the blood, and, in turn, the normalization of serum calcium levels was accompanied by a natural decrease in the level of inorganic phosphate. In patients with initially normal calcium levels, taking additional vitamin preparations had no effect on mineral metabolism parameters. Such dynamics of changes in the studied parameters characterizes a more pronounced improvement in mineral metabolism in patients of subgroup B.

This is evidenced by the results of a study of markers of bone tissue remodeling. When studying parathyroid hormone - the main regulator of the metabolism of phosphorus and calcium, their concentration in the blood and the absorption of calcium in the small intestine - the dynamics of the decrease in the level of this hormone in patients in all groups was monitored after the end of the course of pharmaceutical treatment supporting dental implantation.

Conclusion: The one two three complex may affect the balance of calcium and phosphorus in the body, affecting calcium levels and, in turn, parathyroid hormone levels. This represents some form of physiological regulation where calcium balance in the body is maintained and normal calcium levels are restored when necessary, taking into account the regulation of PTH. Thus, thanks to a comparative assessment of treatment methods, it can be noted that the “one two three” complex is more effective in restoring the components of mineral metabolism in the blood, helps maintain the required level of calcium in the blood, reducing the production of PTH and thereby inhibiting the processes of bone tissue resorption.

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