

Results of Densitometric Studies in Patients with Type 2 Diabetes Who have had COVID-19 During Prosthetics with Removable Dentures

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Abstract Based on the conducted studies, the degree of dysfunctional states of the alveolar processes under prostheses in the pre-rehabilitation period and after prosthetics were studied and evaluated. The obtained scientific data assess the most critical periods of the severity of pathological changes in the dental system that occur against the background of type 2 diabetes mellitus and the infectious disease Covid-19. The results of the study made it possible to compare and evaluate the severity of pathological changes in the alveolar process under the prosthesis, depending on the duration of the disease. Based on the conducted densitometric study, the high efficacy of the Osteogenon drug was established when they were included in the complex therapy of inflammatory diseases of the oral cavity in patients with type 2 diabetes mellitus and those who had the infectious disease Covid-19.

Keywords Post-COVID-19 symptoms, Bone atrophy, Removable dentures, Type 2 diabetes mellitus

1. Relevance of the Problem

The most common pathological changes in the oral cavity tissues that occur in patients with type 2 diabetes who have had Covid-19 are: inflammatory changes in the gums, periodontal, and bone tissue of the jaws, mainly of an erosive and ulcerative nature [2]. These processes are aggravated by general intoxication of the body, which is caused by an increased blood glucose content, an increase in the level of calcium and a decrease in the level of phosphorus, which leads to a violation of the processes of bone remodeling, manifested in diabetic osteoporosis. The results of an X-ray study indicate that in patients with a long period of disease with type 2 diabetes mellitus, as well as those who received hormone replacement therapy in the treatment of the consequences caused by the infectious disease Covid-19, the dental status is characterized by rapid atrophy of the alveolar processes of the jaws, as a result of the progression of bone resorptive processes [1]. According to WHO data, 422 million people currently suffer from diabetes mellitus (DM), which is more than 6% of the world's population. The importance of early diagnosis and treatment of this endocrine disease in the world is rapidly increasing in parallel with the increase in the number of patients, as well as the progression

of the severity of complications arising from this disease, and, according to forecasts, by 2030, diabetes mellitus will become the seventh leading cause of death in the world. One of the rapidly spreading diseases and risks of serious complications, along with diabetes mellitus, is an infectious disease of viral origin-Covid-19. To date, official WHO statistics indicate about 700 billion survivors of this disease, which in turn exacerbates the course of concomitant general somatic diseases, and also triggers the emergence of new ones [8].

Objective: To assess the dental status of patients and develop measures for dental rehabilitation of patients with type 2 diabetes mellitus who have had Covid-19.

2. Materials and Methods of Research

This scientific study was conducted at the Department and Clinical Department of the Faculty of Orthopedic Dentistry of the Tashkent State Dental Institute, for the period from 2020 to 2023.

The study included 60 patients with partial secondary adentia, 33 (36.7%) men and 57 (63.3%) women. A detailed diagnosis of type 2 diabetes mellitus was established by endocrinologists in accordance with WHO clinical and laboratory criteria (1999). Patients of both study groups received inpatient treatment in the endocrinology department of a multidisciplinary hospital based on the 3rd clinic of the Tashkent Medical Academy.

The patients' diagnosis of SARS-CoV-2 S-RDB (Covid-19) virus infection was confirmed by ELISA and IHL.

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The study patients (90 people) were divided into 3 groups:

The control group consisted of 30 people without pathology of the dental-maxillofacial, cardiovascular and endocrine systems;

I the main group consisted of 30 people who acquired type 2 diabetes against the background of the transmitted infectious disease Covid-19;

Comparison group 2 consisted of 30 people suffering from type 2 diabetes who had had the infectious disease Covid-19.

Patients of the study groups were assigned a complex treatment, including the use of systemic drugs. The drug from the group of calcium-phosphorus metabolism regulators – "Osteogenon", aimed at improving bone mineralization and

reducing resorptive processes, was recommended to be taken orally 1-2 tablets, 2 times a day, for a course of 3 months.

3. Results and Discussions

During X-ray examination of the obtained images, attention was paid to the preservation of compact alveolar plates, the structure of bone tissue, and the densitometry function was used to assess the intensity of gray tone, which characterized the density of newly formed bone tissue in the area of the postoperative defect. In addition, the study of bone atrophy of the jaws was carried out using markers according to the previously described method. (**Table 1**)

Table 1. Results of densitometric study in patients of the study groups after prosthetics and applied complex treatment in dynamics

| Duration group | Before treatment | After 1 month | After 3 months | After 6 months | After 12 months |
|----------------|------------------|---------------|----------------|----------------|-----------------|
| Control | 153,3±1,73 | 150,9±2,72 | 148,9±2,83 | 149,5±3,01 | 151,9±3,05 |
| I Group I | 92,54±0,92 | 105,3±2,15 | 116,3±2,93 | 148,9±2,76 | 144,9±2,81 |
| II Group II | 67.33±3.11 | 69.82±3.09 | 108.4±3.32 | 122.3±3.14 | 97.32±2.94 |

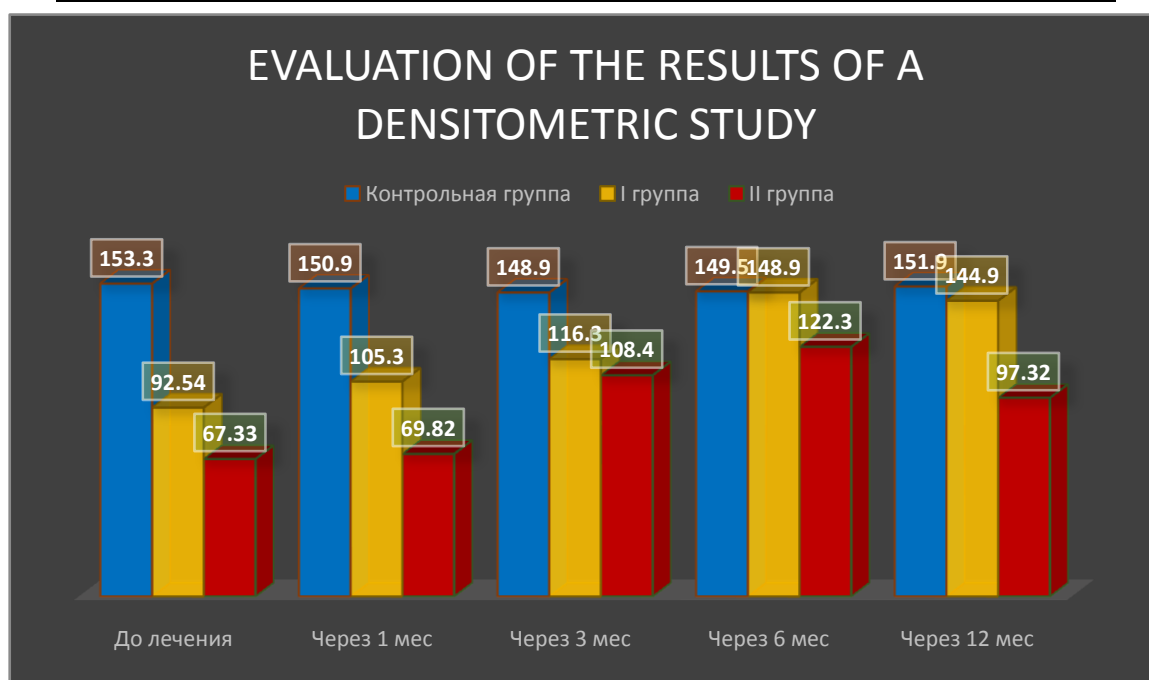


Figure 1. Results of densitometric study in patients of the study groups after prosthetics and applied complex treatment in dynamics

At admission, all patients of the study groups had and recorded the average values of bone density indicators of the jaws obtained by densitometric X-ray examination. So, in patients of the control group, the average value of this indicator was 153.3±1.73, in patients I of group I-92.54±0.92, II in group II-67.33±3.11. According to the table, it can be concluded that the bone density of the jaws in patients suffering from diabetes mellitus for a long time before the infectious disease Covid-19 was significantly reduced compared to the control group (by 56.07%) and I Group I (by 27.22%). The obtained result of the study in IIgroup II

patients is associated with the fact that patients suffering from type 2 diabetes mellitus have a long period of violation of the formation and regulation of parathyroid hormone, which increases the release of calcium from the bones into the blood, and violation of renal filtration and reabsorption processes contribute to the release of excess calcium in the urine from the body. Also, the lack and insufficient effectiveness of insulin affect the mechanisms of regulation of calcium metabolism, in which osteoblasts and osteoclasts of bone tissue do not receive enough calcium ions necessary for the formation of an organic bone matrix, which increases

the risk of developing osteoporosis. 1) The transmitted infectious disease Covid-19 in a contingent of patients with type 2 diabetes mellitus is a factor that leads to a violation of the formation of vitamin D in the patient's body, which can worsen the metabolic processes of vitamin D regulation and reduce the level of its active form in the blood (calcitriol), which in turn negatively affects the metabolism of vitamin D calcium in bone tissue. Long-term use of glucocorticosteroids drugs included in the complex treatment of the burdened course of the infectious disease Covid-19 worsens the reparative processes occurring in the bone tissue of the entire body, including the jaws, reduces the absorption of calcium ions from food and increases the excretion of calcium by the kidneys from the body in the urine. In patients I of group I, there is also a tendency to lower bone density of the jaws, but less pronounced, compared to patients II of group II, this may be due to the presence of the so-called calcium reserve in the bone structures of the body, which is available at the time of manifestation of endocrine disorders of the body caused by the infectious disease Covid-19.

1 month after the prostheses were applied and used, as well as taking the drugs included in the proposed complex treatment method, some changes in the average values of bone density in the study groups were obtained: 150.9 ± 2.72 in patients of the control group, 105.3 ± 2.15 in patients I of group I, which is 15.25% more in comparison with the values obtained on the previous term of the study. In II group II patients, minor changes in the bone density of the jaws were obtained, the average value of the indicator one month after the prosthesis and treatment was 69.82 ± 3.09 . At the 3rd month of taking the drug Osteogenon, which is included in the complex treatment we proposed, the study groups showed a tendency to increase the average value of the bone density index, so in I group I of patients this indicator increased by 10.46% compared to the previous study period and amounted to 116.3 ± 2.93 , and in group II - 108.4 ± 3.32 , which exceeds the values of the previous the duration of the study is increased by 1.5 times. Six months after the prostheses were applied and used, as well as taking medications included in the proposed complex treatment method, the average value of jaw bone density in patients I of group I practically did not differ from the indicator in the control group (148.9 ± 2.76 and 149.5 ± 3.01 , respectively), which indicates a favorable dynamics of the reparative process of jaw bone at against the background of taking the drug Osteogenon. In II the study group II, there was also a positive trend of changes in jaw bone density compared to the previous study period (12.82% higher), but the average value of jawbone density in this group was lower by 18.18% in the control group and 17.86% in the first group of patients.

A year later, according to the densitometric study, it can be concluded that patients II in group II after discontinuation of the drug Osteogenon have a decrease in bone density of the jaws (97.32 ± 2.94), in comparison with the results obtained at the study period after 6 months, as well as in comparison

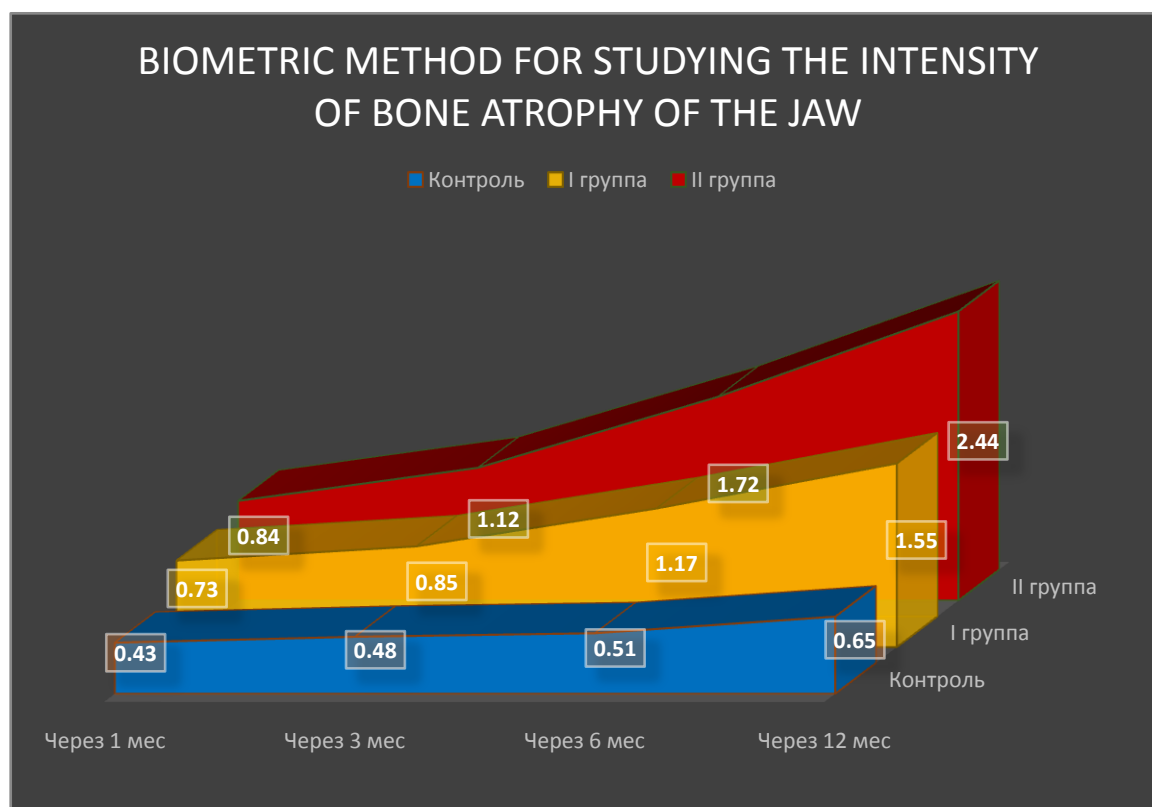
with the results of other groups, where the average value of The mean bone density index was 122.3 ± 3.14 ; at the same time, in patients of the first group, the average bone density index was 144.9 ± 2.81 cu ($p < 0.05$), and in patients of the control group, 151.9 ± 3.05 CU ($p < 0.05$). Comparing the results of bone density in the main group with previous studies and data obtained in patients of the control group, we can say that bone tissue recovery in patients with type 2 diabetes mellitus that occurred against the background of Covid-19, to whom we were prescribed the drug Osteogenon, which is part of the complex treatment, is achieved by 6 months after start of treatment in contrast to group II. Taking the average bone density index in patients of the control group for 6 months after the start of treatment and application of prostheses as the maximum possible, it can be stated that at 3 months the following results were achieved: in patients in I group I, an increase in bone density was 77.8%, and in patients II in group II, 72.4%. Thus, reparative processes of jaw bone tissue restoration were best observed in patients of the first group.

To assess the intensity of bone atrophic processes in patients of the study group, a number of biometric measurements were performed on plaster models of the jaws obtained 1, 3, 6 and 12 months after the start of taking the drug Osteogenon, which is part of the proposed complex treatment and application of prostheses.

1 month after prosthetics with partially removable prostheses, the intensity of atrophic processes in patients of the first group averaged 0.73 ± 0.04 mm ($p < 0.05$), in the second group 0.84 ± 0.03 mm ($p < 0.05$), which is 69.77% and 95.35%, respectively, higher than the value obtained in patients of the first group. patients of the control group (0.43 ± 0.03 mm). After 3 months of using CPP, the loss of prosthetic bed tissues in patients of the first group averaged 0.85 ± 0.11 mm ($p < 0.05$), in patients of the second group 1.12 ± 0.18 mm ($p < 0.05$), which is 1.77 and 2.3 times higher, respectively, than the intensity of alveolar process atrophy under the influence of using the prosthetic structure than in patients of the control group. After 6 months, the average biometric index of bone loss of the prosthetic bed in patients of the first group was 0.44 mm higher compared to the initial study, and in patients of the second group - 0.88 mm. At 6 months, postoperative defect tissue repair in patients of the first group averaged 1.5 ± 0.08 mm ($p < 0.05$), in the second group - 2.0 ± 0.08 mm ($p < 0.05$) and in the third group - 2.07 ± 0.11 mm ($p < 0.05$), which is 0.57 mm more than in patients of the control group in the first group, and by 0.07 mm more than in patients of the second group. After one year of using the prosthetic structure, the intensity of atrophic processes in the first group was 1.55 ± 0.05 mm ($p < 0.05$), in the second - 2.44 ± 0.27 mm ($p < 0.05$). Thus, during the year, the average biometric index of the intensity of atrophic changes in patients I of group I was 112.3%, and in patients II of group II - 190.5%, as for the control group, the average value underwent a decrease in the level of bone tissue by 50% per year.

Table 2. Results of the study of bone atrophy in patients of the study groups after prosthetics and applied complex treatment in dynamics, mm

| Term group | After 1 month | After 3 months | After 6 months | After 12 months |
|---------------|---------------|----------------|----------------|-----------------|
| Control | 0,4343±0,03 | 0,4848±0,01 | 0,551±0,09 | 0,65±0,05 |
| I Group I | 0,73±0,04 | 0,85±0,11 | 1,17±0,12 | 1,55±0,05 |
| II Group II | 0,84±0,03 | 1,12±0,18 | 1,72±0,18 | 2,44±0,27 |

**Figure 2.** Results of the study of bone atrophy in patients of the study groups after prosthetics and complex treatment in dynamics, mm

4. Conclusions

Preparative processes of bone tissue were most intense in the first group of patients, where by 6 months after the start of treatment, it is possible to state the completion and relative stabilization of the processes of bone tissue restoration. Throughout the entire study, the intensity of atrophic processes of prosthetic bed tissues, according to the biometric study, was minimal in patients of group I, which confirms the effectiveness of the proposed method of comprehensive prevention of atrophic processes of prosthetic bed tissues using the drug "Osteogenon", which is included in the proposed comprehensive treatment.

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