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ANALYSIS OF THE RESULTS OF DENSITOMETRIC MEASUREMENT OF THE DEGREE OF DENSITY OF BONE TISSUE IN GROUPS OF PATIENTS WITH ACQUIRED DEFECTS OF THE LOWER JAW AFTER SURGICAL TREATMENT

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Annotation: During orthopedic treatment of patients after resection of cancerous NPs, receiving antitumor therapy, and, in parallel, taking a course of anti-osteoresorptive drugs and drugs that stimulate osteo-modifying processes in bone tissue, the mineral density of peri-implant bone tissue increases. Densitometry study and study of the stability of implants using the method of frequency resonance analysis using the Penguin RFA device (Sweden), allows us to give a comparative assessment of the changes in the density of the bone tissue of the lower jaw in the area of implanted dental implants at different periods of the study in dynamics.

Key words: Tumor neoplasm, resection, defects and deformations of the lower jaw, orthopedic rehabilitation, dental implants, electromyography.

Relevance of the topic. To date, dentistry has accumulated significant clinical experience in orthopedic treatment of dentition defects using dental implants. Compared to traditional removable orthopedic structures, dental implant-supported structures significantly improve the patient's quality of life, providing greater comfort and functionality [2,3]. At the same time, with large defects in the dentition and severe atrophy of the bone tissue of the jaws due to tooth loss, dental implantation is difficult. The preliminary use of surgical methods aimed at increasing the volume of bone tissue in the maxillofacial area, such as autologous bone transplantation, intercortical osteotomy and directed bone regeneration using membranes, allows expanding the indications for the use of dental implants in conditions of atrophy of the jaw bone tissue at the sites of their installation. To replace defects and deformations of the maxillofacial area, artificial materials representing titanium mini-systems, namely porous and non-porous materials made of titanium nickelide alloy, have become widely used. Numerous sources describe positive experience in effective and high-quality reconstruction and replacement of defects in the maxillofacial area using these materials, which also increases prospects for future research. [1,4,8]

However, despite the improvement in the standards of aesthetics of the facial area and the effectiveness of replacing defects of the jaw bones, often in patients after surgical interventions related to the reconstruction of the maxillofacial area, the process of providing orthopedic dental care becomes more complicated, since conditions in the oral cavity deteriorate and the process of installing dentures ends unsatisfactorily result for both the patient and the attending orthopedic surgeon.

Ways to solve the above problem were found when planning and carrying out the stages of orthopedic rehabilitation of this group of patients using dental implants. Classic dental implants have been successfully used in dental practice for more than half a century for the

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treatment of partial and complete edentia and are a supporting component for fixing removable and fixed orthopedic structures. [1,5,6,8]

Purpose of the study: To analyze the results of densitometric measurement of bone tissue density in groups of patients with acquired defects of the lower jaw after surgical treatment of malignant tumors before and after orthopedic treatment supported by dental implants.

Materials and methods. Depending on the proposed treatment plan, all patients (90 people) were divided into groups:

Group I consisted of 30 patients with a fixed temporary prosthesis fixed on dental mini-implants and a fixed permanent prosthesis supported on classic dental implants + the proposed comprehensive general somatic treatment.

Group II consisted of 30 patients with simultaneous implantation and immediate (temporary) prosthetics.

Patients of group I with tumors of the lower jaw underwent surgical resection of the affected segment of the lower jaw with a tumor formation, removal of teeth in this area and replacement of the defect with a nickel-based titanium endoprosthesis, installation of dental mini-implants on the remaining areas of the alveolar process of the lower jaw. 2 weeks after surgery, the finished temporary fixed bridges were fixed to the dental mini-implants.

At this stage, all patients of main group I (100%) received a course of chemotherapy treatment. As part of complex treatment, patients were recommended to undergo a course of osteo-modifying therapy. The main drug of choice was the bone resorption inhibitor Bonviva. The course duration and dosage regimen were 150 mg orally once a month for 6 months. Additionally, it is recommended to take calcium 1000 mg/day and vitamin D 1000 IU throughout the entire period of antiresorptive therapy.

After 8 months, the patients had temporary prosthetic structures removed and classic dental implants installed, and after another 3 months, permanent orthopedic metal-ceramic dental structures were manufactured and fixed and adaptive rehabilitation measures were carried out.

Patients of group II underwent surgical resection of the affected segment of the lower jaw with a tumor formation, direct replacement of the nickelide defect with a titanium endoprosthesis, and installation of traditional dental implants using a one-stage technique. Two weeks after surgery, a provisional fixed plastic bridge was fixed. At this stage, patients received a course of chemotherapy treatment and a course of osteo-modifying therapy.

After 4-6 months, the patients had provisional prosthetic structures removed, permanent orthopedic dentoalveolar structures supported by dental implants were manufactured and installed. A prerequisite for carrying out these measures in patients was the achievement of radiologically confirmed absence of osteolytic processes.

For the control group, 30 patients were selected who had no history of tumor tumors, no cardiovascular pathology, who were admitted to the orthopedic dentistry department with a diagnosis of “complete secondary adentia of the lower jaw” and who underwent dental orthopedic treatment with the installation of dental implants.

X-ray densitometric study was carried out to assess the condition of the bone structures of the lower jaw before treatment, planning prosthetic methods and assessing the quality of the result obtained after surgical interventions and complex orthopedic treatment using classical and mini-dental implants.

X-ray examinations were performed using an Orthophos XG 3 DS device at the TDSI orthopedic dentistry clinic. A total of 60 orthopantomograms were studied. Determination of bone tissue density and parameters of the alveolar process/part of the jaw

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was carried out using Sidexis software.

To determine the stability of the implanted dental implant at various stages of osseointegration, we used the Penguin RFA device (Sweden). The work of this device is aimed at determining the shock-absorbing properties of periodontal tissues. The device consists of 2 main parts: a system unit and a tip, connected to each other by a cable. The working element of the tip is the striker, which includes a piezoelectric element that operates in 2 modes: generating and receiving.

The first cycle is the excitation of a mechanical shock impulse and its transmission to the striker. The second is receiving feedback from the mechanical system and transmitting information to the microprocessor. The reproduced acoustic vibrations are displayed on the device display and are accompanied by a sound signal. To more accurately determine the value of the stability indicator, the device should be 0.7-2.0 mm away from the surface of the dental implant and at an angle of 90 degrees to the tip. Frequency is expressed in ISQ (Implant Stability Quotient) units on a scale from 1 (lowest stability) to 99 (highest stability). During the research process, we followed the manufacturer's recommendations.

Results and their discussions. Based on the results of osteodensitometry of the peri-implant area, the value of the indicator was calculated for the first and second main groups and the control group during the periods: upon admission, 3 months, 6 months and 12 months after installation of permanent dental implants and subsequent prosthetics. The periotestometry study was carried out 3 months, 6 months and 12 months after implantation of permanent classical dental implants. From 4-6 months of the study, dental implants were loaded with a fixed orthopedic structure on the lower jaw.

All patients (100%) of both main study groups admitted to the department of orthopedic dentistry were clinically diagnosed with dystrophic changes in the periodontium, namely gingivitis (n=54), moderate periodontitis (n=37), severe periodontitis (n=23).

The data obtained from the study of orthopantomograms of patients in the control group who did not have clinically identified pathological changes in periodontal tissues were taken as the norm for bone tissue mineral density.

Table 1. Indicators of mineral density of bone tissue around implants for the entire observation period in various comparison groups.

Observation period, months	Group I	Group II	Control group
On admission	61±0,03	63±0,06	70±0,07
3	58±0,04	59±0,02	62±0,09
6	62±0,02	61±0,04	64±0,06
12	69±0,01	63±0,01	71±0,01

Table 2. Indicators of the stability coefficient of implants for the entire observation period in various comparison groups.

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Observation period, months	Group I	Group II	Control group
On admission	1 гр	2 гр	контроль
3	52,3±3,8	61,2±3,4	62,7±4,3
6	62,4±2,8	58,1±4,5	68,4±3,2
12	70,3±4,3	51,5±4,7	73,3±4,4

The results of an X-ray diagnostic examination of patients of both main groups upon admission with dystrophic changes in the periodontium of the lower jaw, clinically manifested in the form of gingivitis of moderate and severe severity and periodontitis of moderate and severe severity, with concomitant tumor formation, indicated the presence of changes in the mineral density of the bone tissue of the lower jaw.

When studying the control radiological data of patients of the first main group, who underwent surgical treatment of a tumor formation (resection of the affected area of the lower jaw) with direct replacement of the formed defect with a nickelide titanium endoprosthesis and installation of temporary implants, we noted that a month after fixation of the titanium plate, the bone structure the tissue of the area of the body of the lower jaw bordering the endoprosthesis remains practically unchanged in this group of patients. Also, an X-ray examination showed satisfactory results in restoring the continuity of the mandibular arch while maintaining the natural anatomical structure of the lower third of the face. Dynamic restoration of the function of mouth opening and swallowing was observed. A mild periosteal reaction was also observed in the areas around all mini-implants.

The results of the examination in this group 3 months after the reconstructive surgery showed that in 1 (3.3%) case there was a pressure sore around the reconstructive plate, while in the remaining cases (96.7%) there were good conditions for subsequent dental implantation.
In Fig. 1. The dynamics of changes in the mineral density of bone tissue around the implants for the entire observation period in various comparison groups is presented.

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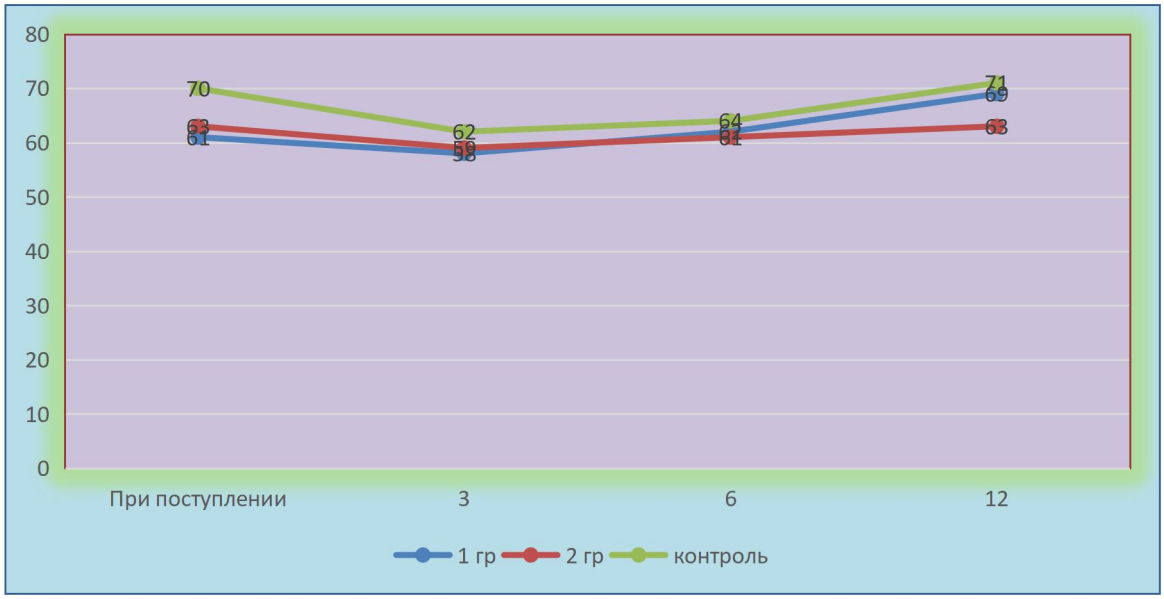
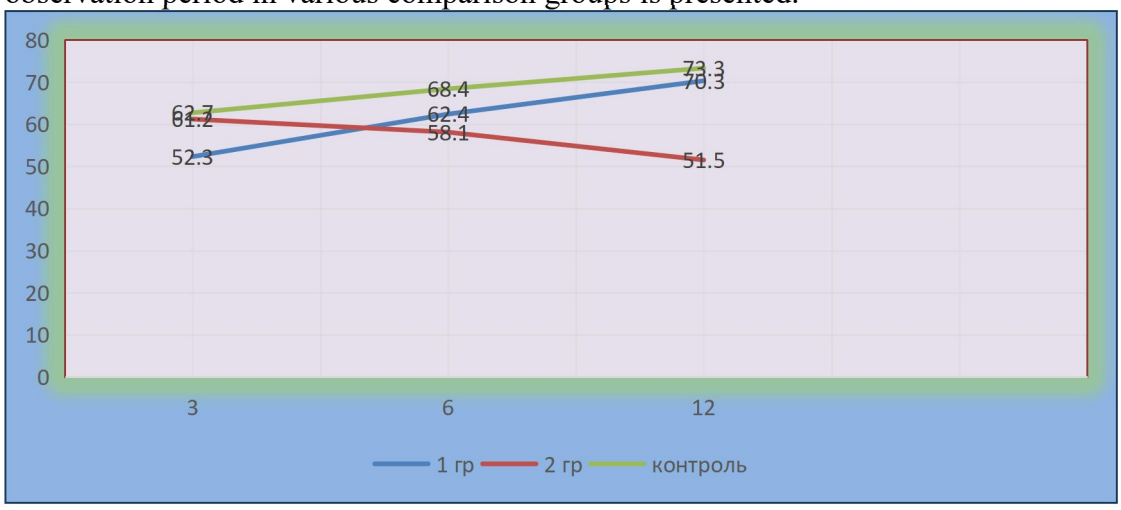


After 3 months after the installation of classic permanent implants, we observed the following indicators of a densitometric study of the density of the bone tissue of the lower jaw. We noted a decrease in bone tissue density in the area of installed implants in all three observation groups. Thus, the percentage decrease in LF bone density in patients of Group I was 5.2% compared to the background study upon admission; in Groups II and control, this percentage was 6.7% and 12.9%, respectively.

Changes during this period of the study indicate that a period of adaptation occurs in the bone tissue in the area of the implants.

When studying the stability of installed implants using periostometry 3 months after implantation surgery in the group of patients with direct loading of implants, the obtained indicators were practically no different from the indicators of the control group (61.2±3.4 and 62.7±4.3 units, respectively). In patients with delayed implant loading at this period of observation, it was significantly lower compared with the indicators of group II and the control group, and amounted to 52.3±3.8 units.

In Fig. 2. The dynamics of changes in the stability coefficient of implants over the entire observation period in various comparison groups is presented.



Six months after the implantation of classical dental implants, small areas of osteoporosis and compaction of bone tissue in the zone of fixation of the titanium plate to the body of the

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NP, as well as developing zones of osteoporosis around the implants, are observed radiologically in patients of group II, and a periosteal reaction is detected. Bone density in this group of patients remained virtually unchanged compared to the previous study. In patients of group I, at the junction of the titanium endoprosthesis with the body of the lower jaw, there are small zones of osteoporosis, but signs of its fusion with the sawdust of the jaw predominate. The structure of the bone tissue around the implants is osteoporotic in places, however, the mineral density of the bone tissue of the lower jaw in this area was restored to the values obtained during the background densitometry study and amounted to 62 ± 0.02, which is only 3.2% lower than the indicator obtained in the group control at these study periods (64±0.06).

At this time, the period of adaptive changes in bone tissue gradually activates osseointegrative processes and the formation of new bone around the implants, as well as the saturation of its mineral component, and as a result, the density of the jaw bone tissue increases at the sites of dental implants and around the titanium endoprosthesis. That is, adaptation mechanisms continue to operate throughout the study, despite minimally changed dynamics. It is worth noting that the processes of osseointegration and formation of new bone tissue in patients in the delayed loading group occur more actively than in patients in the comparison group.

After six months, the average stability of the installed implants differed in all three comparison groups. Thus, in patients of Group I, with delayed orthopedic loading of implants and receiving complex treatment, stability indicators were higher by 16.2%, compared with the previous period of the study (62.4±2.8 units) and by 7.4% higher, in comparison with Group II of patients in which the average value of stability at this period of observation was 58.1±4.5 units. The highest average value of stability of dental implants in the lower jaw was observed in the control group - 68.4±3.2 units. However, the data from both comparison groups were not high enough, which is a consequence of the weakening of a larger number of dental implants due to overload with extended fixed bridges (Group II) and disruption of osseointegration processes due to disruption of the physiological restructuring of bone tissue under the influence of chemotherapy.

In patients of main Group I, radiologically it is clear that the anatomical integrity of the lower jaw was unchanged. The bone tissue adhered tightly to the implants throughout, without differing from the surrounding bone structures, the trabecular pattern was uniform. Along the periphery of the implants, the bone tissue had a normal structure, and there was no zone of osteoporosis. A year after implantation, a progressive increase in bone tissue density around the implants was determined in the main Group I and the control group - 69±0.01 and 71±0.01, which is 19 and 14.3% higher, respectively, compared to the study carried out 3 months after the operation of installing permanent dental implants. We did not note a complete restoration of bone tissue density around the implants; in patients of Group II, the percentage in this group did not undergo significant changes compared to the previous periods of the study and amounted to only 62±0.01.

12 months after the installation of dental implants, in the group with delayed loading and the treatment we proposed, stability increased to 70.3 ± 4.3 units. and was close to the indicators obtained in the control group - 73.3±4.4 units, while in patients in the group with direct loading of implants and without special therapy, stability decreased to 51.5±4.7 units, which is 26% and 30 % lower than in the first main group and in the control group, respectively. During the year of the study, the decrease in the average stability of dental implants, in

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percentage terms, was 16% for group II, and the increase in stability indicators for the main group I and the control group was 25.6% and 14.4%, respectively.

Conclusion. Thus, we can conclude that during orthopedic treatment of patients after resection of cancerous NPs, receiving antitumor therapy, and, in parallel, taking a course of anti-osteoresorptive drugs and drugs that stimulate osteo-modifying processes in bone tissue, the mineral density of peri-implant bone tissue increases. Densitometric study and study of the stability of implants using the method of frequency resonance analysis using a Penguin RFA device (Sweden) allows us to give a comparative assessment of the manifested changes in the density of the bone tissue of the lower jaw in the area of implanted dental implants at different periods of the study in dynamics. This research was carried out without financial support from manufacturers.

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