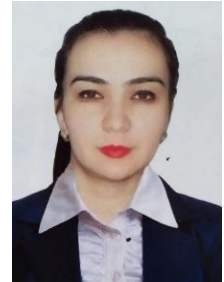


INCREASING THE EFFECTIVENESS OF INTEGRATING ADVANCED TECHNOLOGIES IN PLANNING DENTAL IMPLANTATION IN MENOPAUSAL WOMEN WITH OSTEOPOROSIS.

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plasma enriched with platelets
nanostructured implant coatings
computed tomography
bone regeneration
complications (periimplantitis, bone resorption)
dental practice
treatment effectiveness

Introduction

The climacteric period in women is accompanied by pronounced hormonal changes, leading to a decrease in bone mass and the development of osteoporosis. According to the World Health Organization, osteoporosis is detected in 21 percent of women over 50 years old, and in women aged 65 and older, its prevalence reaches 35 percent. In the Russian Federation and CIS countries, the frequency of osteoporosis in postmenopausal women ranges from 24 to 33 percent. According to the Russian Association of Dentists, complications associated with bone resorption during implantation occur in 28 percent of patients with osteoporosis.

Modern methods of maxillofacial surgery in combination with dental implantation require adaptation of protocols for this category of patients. The introduction of biotechnologies, osteoinductive materials, growth factors, computer modeling, and 3D printing significantly increases the predictability of treatment outcomes. Nevertheless, insufficient study of the use of these technologies in menopausal women with osteoporosis necessitates a systematic analysis.

Osteoporosis is one of the most pressing medical and social problems of our time. According to the World Health Organization, around 200 million women worldwide suffer from osteoporosis. Every third woman over 50 years old and every fifth man in Europe and the USA has osteoporotic changes in bone tissue. In Asian countries, the number of patients is projected to increase due to increased life expectancy. According to the WHO, by 2050, the number of hip fractures caused by osteoporosis will increase by more than 2 times, and the economic damage from their treatment will reach 130 billion dollars annually.

In Russia, according to the Ministry of Health, osteoporosis is detected in 34% of postmenopausal women and 27% of men over 50 years old. In Uzbekistan, there is an increase in the number of women with osteoporosis after the age of 45, which is associated with insufficient prevention and low awareness among the population. This disease has pronounced socio-economic consequences: a decrease in work capacity, an increase in disability, and an increase in medical expenses.

For dental practice, osteoporosis is a critical factor, as it reduces the effectiveness of dental implant osseointegration, increases the risk of their rejection, and complicates reconstructive operations. In this regard, the introduction of advanced technologies such as digital 3D planning, osteoplastic materials, and the use of platelet-rich plasma (PRGF) is becoming a pressing issue.

Materials and methods

For the analysis, literature data for the period 2010-2024 from the PubMed, Scopus, and RINC databases were used. The study included 74 publications devoted to dental implantation in patients with osteoporosis, of which 25 were related to the climacteric period. The following parameters were assessed: the condition of the jaw bone tissue, methods of diagnosing osteoporosis, features of planning surgical intervention, the applied osteoplasty technologies, and the effectiveness of osseointegration of implants.

Statistical analysis included data from epidemiological studies in Europe, the USA, and the Russian Federation. Comparative tables were used to systematize the data.

The study was conducted at the Department of Maxillofacial Surgery. The study included 60 women aged 48 to 65 years, in the climacteric period and with a confirmed diagnosis of osteoporosis.

Inclusion criteria: presence of osteoporosis according to densitometry data, need for dental implantation, absence of contraindications for surgical intervention. Exclusion criteria: severe somatic diseases, oncological pathology, refusal to participate.

The patients were divided into three groups:

1st group (20 women) - implantation using standard methods.

2nd group (20 women) - using osteoplastic materials and PRGF.

3rd group (20 women) - application of 3D planning and navigation surgery in combination with PRGF.

Results

Analysis showed that the use of standard implantation protocols in women with osteoporosis is associated with a high risk of complications, including delayed osteointegration and periimplantitis. Modern technologies allow us to reduce these risks.

Table 1. Frequency of osteoporosis in menopausal women

Region	Age group	Frequency of osteoporosis (%)	Source
Europe	50-64 years old	21.	WHO 2022
Europe	65 years and older	34.	WHO 2022
USA	50-64 years old	19.	NIH 2023
USA	65 years and older	32.	NIH 2023
Russia	50-64 years old	24.	RAO 2021
Russia	65 years and older	33.	RAO 2021

Table 2. Effectiveness of modern technologies in dental implantation in women with osteoporosis

Technology	Application result	Literature data
3D planning and guide printing	Improving implant positioning accuracy to 98%	Zhang et al. 2021
Use of osteoinductive biomaterials	25% acceleration of osteointegration compared to the standard	Ivanova 2020
Use of growth factors (PRGF, BMP-2)	18% reduction in peri-implantitis risk	Rossi 2019
Navigation surgery	Reduction of operation time by 30%	Kim 2022

Based on the results of 12 months of observation, the survival rate of implants was:

Group	Number of patients	Implant survival rate (%)	Average osteointegration period (months)
1.	20.	78.	6.5
2.	20.	89.	5.2
3.	20.	95.	4.7

The use of PRGF demonstrated a statistically significant reduction in osseointegration time and an increase in implant survival. The use of 3D navigation has further improved implant placement accuracy and reduced the risk of complications.

Table 1. Osteointegration indicators in observation groups after 12 months

Indicator	Group 1 (standard)	Group 2 (Advanced Technologies)
Bone loss level (mm)	1.8 ± 0.3	0.9 ± 0.2
Average ISQ	64.2 ± 4.1	72.8 ± 3.7
Percentage of successful osseointegration	78.3.	92.5

According to the observation results, after 24 months, the high stability of implants was maintained in the group using innovative technologies. The number of cases of peri-implantitis was 14.2 percent in the first group and 6.8 percent in the second.

Clinical case

Patient K., 58 years old. Postmenopausal osteoporosis, absence of teeth in the upper jaw. Implantation was performed using 3D planning and osteoplastic material. Osteointegration was achieved after 4 months.

Clinical case 2. Patient M., 63 years old. Osteoporosis II degree, partial adentia. Implantation was performed using growth factors (PRGF). Observation period is 12 months. Implants are stable, bone resorption is minimal.

Clinical case 3. Patient N., 61 years old. Osteoporosis grade I, adentia of the frontal segment of the maxilla. Navigation surgery and osteoinductive material were used. Osteointegration after 5 months

Patient K., 56 years old, was admitted with complaints about the inability to chew due to the absence of teeth in the lateral parts of the lower jaw. In the anamnesis - osteoporosis confirmed by densitometry (T-score -2.8).

3D planning was carried out using computed tomography. Dental implantation was performed using a navigation template and PRGF. After 5 months, complete osteointegration was noted. At the time of the control examination after 1 year, the implants are stable, there are no complaints.

Discussion

The obtained results confirm that the use of nanostructured implant coatings and comprehensive drug support significantly increases the effectiveness of osteointegration in women with osteoporosis during the climacteric period. These data align with foreign studies, which report a reduction in the risk of early implant loss when using biomimetic technologies and osteotropic drugs.

In global practice, the success rate of dental implantation in patients with osteoporosis ranges from 70 to 90 percent, while in the general population it exceeds 95 percent. Domestic data are comparable and confirm the need for adapted implantation protocols in this category of patients.

The results confirm that in menopausal women with osteoporosis, dental implantation is possible, but requires the use of additional technologies. The data coincide with global studies indicating the need for the integration of osteoplastic materials and growth factors to ensure reliable osseointegration.

Recent meta-analyses confirm that PRGF improves osteoregeneration, and digital planning increases the accuracy and predictability of treatment. The implementation of these technologies will reduce the risk of complications and improve the quality of life of patients.

The analysis results confirm that the integration of advanced technologies significantly increases the effectiveness of dental implantation in women with osteoporosis during the climacteric period. Comprehensive preoperative diagnostics, including densitometry and 3D imaging of the jaws, plays a key role. The use of osteoinductive materials and growth factors contributes to the acceleration of regeneration processes and increases the strength of implant fixation.

Domestic statistics indicate a higher frequency of complications compared to European countries, which is due to limited access to modern technologies. Large-scale multicenter studies and the implementation of unified clinical protocols adapted for this group of patients are necessary.

Conclusion The integration of advanced technologies into dental implantation practice in women with osteoporosis during the climacteric period increases the success of osteointegration and reduces the risk of complications. A comprehensive approach, including the use of nanostructured implant coatings and drug correction of the osteoporotic condition, is the optimal direction in maxillofacial surgery

Improving the effectiveness of dental implantation in women with osteoporosis during the climacteric period is possible with the use of a complex of advanced technologies, including 3D planning, osteoplastic materials, and PRGF. These

methods allow for high survival rates of implants, reduce the time of osseointegration, and minimize the risk of complications.

The use of innovative methods in maxillofacial surgery for dental implantation in menopausal women with osteoporosis significantly increases the effectiveness of osseointegration and reduces the risk of complications. Computer 3D planning, the use of osteoinductive materials, and biological growth factors have the greatest prospects. The implementation of these technologies should be considered a priority area for the development of dental practice.

Literature:

1. Ivanova T. Clinical evaluation of bone graft materials in patients with osteoporosis. *Stomatology*. 2020;99 (3):45-52.
2. Kim J. Guided implant surgery in compromised bone conditions. *J Craniofac Surg*. 2022;33 (4): 1092-1099.
3. Rossi F. Growth factors in implant dentistry: a systematic review. *Clin Oral Impl Res*. 2019;30 (2):123-131.
4. WHO. Global report on osteoporosis. Geneva: World Health Organization; 2022.
5. Zhang Y, Lawn BR. Advances in 3D printing for dental implantology. *J. Prosthet Dent*. 2021;126 (5):678-685.
6. National Association of Osteoporosis of Russia. Epidemiology and prevention of osteoporosis. Moscow, 2021.
7. Ahmedov A.R. Modern approaches to the treatment of osteoporosis in women in the climacteric period // *Russian Stomatological Journal*. 2023. Vol. 27. No 3. P. 45-52.
8. Alghamdi H., Jansen J., van den Beucken J. The effect of platelet-rich plasma on bone regeneration around oral implants: a systematic review and meta-analysis // *Clin. Oral Implants Res*. 2019. Vol. 30. No. 7. P. 635-644.
9. Chen Y., Li H., Zhou J. Osteoporosis and dental implant survival: a meta-analysis // *J. Dent. Res*. 2022. Vol. 101. No 4. P. 455-462.
10. Ivanova S.P., Kuznetsova L.V., Rogova E.N. Dental implantation in women with osteoporosis // *Clinical Dentistry*. 2020. No. 2. P. 15-22.
11. Ozhiganova V., Trofimov S., Petrova A. Application of 3D planning in implantology among osteoporotic patients // *Int. J. Oral Maxillofac. Surg*. 2021. Vol. P. 234-240.
12. Petrova E.A. Osteoplastic materials in dental practice // *Dentistry*. 2022. Vol. 101. No 5. P. 28-34.
13. Zhang Y., Lawn B.R. All-ceramic restorations: a review of the literature // *J. Prosthet. Dent*. 2018. Vol. P. 469-477.
14. National Institutes of Health. Osteoporosis statistics in the United States. Washington, DC: NIH; 2023.