**MINISTRY OF HEALTH OF THE REPUBLIC OF UZBEKISTAN**
**TASHKENT STATE MEDICAL UNIVERSITY**

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# PREPARATION FOR IMPLANTATION IN PATIENTS WITH POST-CYSTIC JAW DEFECTS

(Monograph)

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# Preparation for implantation in patients with post-cystic jaw defects

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The monograph describes the etiology, pathogenesis, and diagnosis of post-cystic jaw defects, and provides recommendations for the treatment of this condition. The author presents a developed strategy for dental practitioners in preparing patients with post-cystic jaw defects for implantation.

The monograph is intended for dental specialists, master's students, and clinical residents in dentistry.

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Scientific Secretary of TGSI, Doctor of Medical Sciences, Associate Professor Yuldashev A.A.

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## LIST OF ABBREVIATIONS

HAP-hydroxyapatite

WHO - World Health Organization

OBST - oral mucosa

PP - Presidential Decree

ESR - Red blood cell sedimentation rate

TSDI - Tashkent State Dental Institute

TMA - Tashkent Medical Academy

TPP - platelet-rich plasma

BMP- morphogenetic protein

GF- growth factor

PDGF - platelet growth factor.

IGF-I- insulin-like growth factor.

DVPs are a morphogenetic bone protein.

FGFs - fibroblast growth factor.

DLCA - demineralized lyophilized bone grafts

VEGF is a vascular endothelial growth factor.

TCR- tricalcium phosphate

BTP- platelet-poor plasma

MSC- mesenchymal stem cells.

CDP - cystic defect of jaw

rh- recombinant

UP A-urokinase plasminogen activator

GTR- directed bone regeneration.

B-TCR-beta-tricalcium phosphate.

## INTRODUCTION

One of the principles of modern medicine is the focus on increasing human life expectancy and quality of life. Achieving these goals, in particular, involves developing materials used for artificial organs and tissues. According to scientific sources, “aw bone cysts rank first among other odontogenic diseases. They occur in people of various ages and form 3 times more frequently in the upper jaw than in the lower jaw. In the outpatient practice of surgical dentistry, radicular cysts account for 78-96% of the total number of cysts and 12% of jaw bone diseases. These figures demonstrate the significance of the problem in treating this pathology...”[1]. In the past decade, the technological process of bone replacement has been associated with the emergence of a new generation of artificial alloplastic materials. However, the fact that such materials are imported to Uzbekistan from both neighboring countries and those further abroad significantly increases their cost, which, in turn, forces some patients to forgo this treatment method.

In the world, numerous scientific and practical studies are being conducted in the field of modern surgical dentistry to improve the treatment of cavity defects formed after odontogenic cysts. Bone tissue restoration does not always occur at the proper level, and regenerative processes proceed at a relatively low rate. Using osteoconductive materials, it is possible to increase the effectiveness of regenerative processes. Numerous scientific and practical studies are being conducted worldwide in the field of modern surgical dentistry to improve the treatment of cavity defects formed after odontogenic cysts. Bone tissue restoration does not always occur at the proper level, and regenerative processes proceed at a relatively slow rate. Using osteoconductive materials can increase the effectiveness of regenerative processes. When using osteoplastic materials, it is necessary to consider not only their composition, dispersity, and qualitative characteristics but also the recipient zone, particularly the degree of damage, the size of the defect gap, and the density of the bone tissue surrounding the defect. Therefore, clinicians face the

[1] Рахимов З.К., Чиргалиев М.Ж., Пулатова Ш.К. Совершенствование методов лечения радикулярных кист челюстей // Электронный научный журнал «Биология и интегративная медицина». 2019. №2 - февраль (30).

challenge of selecting an osteoplastic material that can ensure a positive treatment outcome without requiring substantial financial resources. The development and implementation of cost-effective local materials that provide stable results for complete reconstruction of jaw bone tissue and their introduction into clinical practice remain relevant issues.

According to the literature, 40.6% of dental surgical interventions are performed on radicular jaw cysts (Azimov M.I., Kudratov Sh.Sh., 2016). 76.6% of jaw cysts are accompanied by inflammation, and it should be noted that the process is often chronic. Inflammation is observed in 47.2% of odontogenic jaw cysts (Chernov A.V. et al., 2012). In addition, after removal of the cyst, the formation of bone regeneration often takes 1-1.5 years, and in large cysts, even longer.

One of the most important factors in treating jaw cavity defects is the restoration of damaged bone, a complex biological process controlled by hormones and growth factors that ensure cellular reactions and tissue formation. Various cells, microflora, cytokines, and other factors participate in this process, and the reaction of the entire organism is also important (Boyko E.M., 2017). For this purpose, various surgical methods are used for treatment, biocompatible bone substitutes are used, etc. In this process, the development of molecular and cellular biology, in particular, the study of growth factors involved in regeneration processes along with hormones, plays an important role (Gurin A.N., 2021). The rate of bone regeneration is a crucial factor influencing the successful outcome of bone-plastic operations, including jaw cyst surgeries. To date, a comprehensive approach to the elimination of characteristic odontogenic carious defects developing in the upper and lower jaws has not been identified; Specific treatment algorithms for various types of bone resorption have not been developed.

To date, an algorithm for treating patients with bone defects of varying sizes, both upper and lower jaws, and a comprehensive approach to regulating various cystic bone defects has not been developed. Thus, the use of glass-crystalline materials, which belong to the bioactive group and have high mechanical strength, heat

resistance, are inexpensive, not toxic to the body, and are easy to use, is one of the promising areas of maxillofacial surgery.

# CHAPTER I. MODERN ASPECTS OF USING OSTEOPLASTIC MATERIALS FOR JAW DEFECTS

## §1.1. Odontogenic cysts, their origin and treatment principles.

Analysis of domestic literature data showed that currently, more than 40% of surgical interventions in patients hospitalized in the surgical stomatology department are performed due to the presence of maxillary radicular cysts [5, p.16-18; 16, p.121].

The main reason for the development of radicular cysts of the jaw bones is the presence of a history of chronic apical periodontitis. According to the International Classification of Diseases ICD-10 (1997), all types of root cysts belong to the group of diseases of the oral cavity, salivary glands, and jaws and are defined by the code X1-K04.80.

According to the results of modern research, the mechanism of pre-root cysts formation is associated with the formation of parts of epithelial cells in the apical foci. Previously, the origin of cysts was associated with the remnants of the embryonic epithelium of the dental plate. These epithelial remnants are known as Malyasse cells. However, Malyasse's cells are endothelial cells of the blood vessel wall that accidentally enter the gistological specimen's section. The formation of epithelial cells in the periodontium and bone occurs as a result of the vegetation of the deep layers of gingival epithelium and its invasion into the bone. Although scientists disagree on the mechanism of occurrence of epithelial growths of the upper jaw and periodontium, they agree that cystic growths arise from epithelial elements under the influence of inflammatory processes in the periodontium. This also proves that radicular cysts (94-96%) are more common than follicular cysts (only 4-6%) [5, p.16-18; 16, p.121; 22, pp. 134-137; 199, p.10-12].

According to recent studies, the formation of root cysts is due to the direct mechanical and chemical impact of inflammatory products on the tissues of the periodontal structures, which, in turn, leads to the narrowing of the periodontal

gap, as a result of which the pressure increases, these spaces are gradually filled with transudate. The above leads to the formation of granulomas, an increase in the size of the formed cysts, and this, in turn, affects the bone tissue of the alveolar part of the jaw, causing atrophy of the spongy part of the bone base [22, pp.134-137; 199, p.10-12].

In surgical dentistry, the classification of root cysts by Andruson M.V. (1956) is widely used, according to which all cystic formations are divided into: non-purulent, purulent with a hidden course, and purulent cysts with an acute course, while as complications, phlegmons and abscesses are distinguished.

According to researchers, about 80% of jaw bone cyst formations are accompanied by inflammation, and it should be noted that the process is often chronic [122, p.50-53; 125, pp. 197-204]. Inflammation is observed in 47.2% of odontogenic jaw cysts [75, p.149-152].

In many cases, cysts with necrotic pulp develop in front of the tooth roots. In most cases, radicular cysts develop near horses with decayed pulp. The initial stage of their formation is formed by saccid granulomas that grow into the epithelium. Their development is preceded by encapsulated granulomas that germinate as epithelial strands. According to N.A. Astaxov, it is incorrect to consider epithelial granuloma as an incomplete cyst. This is a chronic hyperplastic periodontitis that easily transitions into a cyst.

Root cysts can be considered as a product of a prolonged inflammatory process of the apical branch, predominantly epithelial granulomas [5, p.16-18; 16, p.121]. Thus, it should be assumed that a radicular cyst is a product of a prolonged inflammatory process in the parietal region, most often epithelial granulomas [5, p.16-18; 16, p.121]. At the same time, according to researchers, it can be argued that the main reason for the formation of radicular cysts is the presence of chronic inflammatory products in the apical part, leading to the development of epithelial granulomas [5, p.16-18; 16, p.121]. Among the etiopathogenetic factors contributing to the development of odontogenic cysts, the following should be highlighted: increased permeability and inflammatory exudate, the

formation of granulation tissue, and the proliferation of the epithelial layer of the cystic formation.

Obligate anaerobes are detected in purulent-inflamed cysts. Streptococci are often present in granulomas and granulation foci, according to Rudelt (2019), among the microbes, streptococci and staphylococci are numerous.

According to Yatr et al. (2018), 98.2% of bacterial strains isolated from jaw cysts are anaerobic.

Root cysts are closed cavities lined with epithelium and filled with fluid. The wall of the cyst is formed from surrounding tissues and has the appearance of a sac, the inner surface of which is more or less completely covered with an epithelial layer. The cystic fluid is yellow, odorless, and contains cholesterol crystals. The dystrophic state of these crystals is evidenced by the dark brown color of the cystic fluid or the partial transition of this fluid to an ointment-like consistency.

An extensively growing (expansive) cyst exerts pressure on the surrounding bone tissue, causing these tissues to break down, and the cyst occupies more space in the jaw. During its growth, the cyst can crush the roots of adjacent teeth, compress the passing blood vessel, join the nerve-vascular bundle passing through the mandibular canal in the mandible, and cause the canal to narrow.

Usually, non-inflamed odontogenic cysts proceed asymptomatically, after the cyst has grown sufficiently large, the patient complains of jaw deformation.

Odontogenic cysts are often detected in patients when they are accompanied by inflammation. When diagnosing and treating radicular cysts, it is necessary to determine the size of the cyst to choose a surgical operation. There are different opinions on this matter in the literature. To choose a surgical approach in diagnosis and treatment, it is advisable to divide the cysts by size into three groups:

Group I - includes a cyst spread only in one alveolar segment of the tooth;

Group II - root ridges of adjacent teeth located on one or both sides, except for the tooth causing the cyst cavity to fall out, i.e., the spread of the cyst to the

alveolar segment of two or three teeth;

Group III - includes cysts extending to the alveolar segments of more than three teeth.

During the period of small size, the cyst develops in the bone tissue of the alveolar septum itself, with no external signs, so the diagnosis is made only based on the X-ray image. With small cysts, in some cases, an image taken from the inside of the mouth is sufficient. In large cysts, an additional jaw orthopantomography or panoramic radiography should be performed, and in some cases, a series of additional images should be taken to determine the tumor's boundaries. X-ray examination is absolutely necessary both when making a diagnosis and when choosing a surgical intervention.

Many authors suggest that radicular cysts of the upper jaw can be treated conservatively and surgically. In his monograph, the author explained the recommendations for endocanalitic treatment of this disease. However, in the treatment of large cysts, the surgical method was considered radical and preferred over the therapeutic method [5, p.16-18; 16, p.121].

The most rational and effective treatment method for radicular cysts is surgical treatment. In this case, the choice of surgical treatment method for radicular cysts depends on: the size of the cyst, its location in which part of the jaw, the patient's age, and the presence or absence of a related pathological process. Thus, in the presence of small cysts, surgical treatment involves the following stages - opening the cyst, scraping and separating it, suturing the mucous membrane into the bone base (Part-2), and cystctomy. After surgical manipulations in the cystic cavity, the removed bone tissue fragments are filled with blood, the cellular elements of which, as restorative processes develop, are reorganized into connective tissue. If the rupture is larger than a cherry, the treatment is less reliable, because in this case, the contraction of the thrombus is more effective, and a rupture may appear. The likelihood of infection increases, and the process of thrombus suppuration may begin. Seam rupture is observed. Consequently, it is most expedient to remove one wall of the cyst simultaneously

with a section of bone tissue of the alveolar process against the background of preserving the integrity of the opposite wall of the cystic cavity, i.e., it is necessary to perform a cystotomy. However, this surgical intervention is not the most effective treatment method due to the prolonged postoperative healing of the wound surface. Consequently, the search for new, more effective methods of surgical intervention for radicular cysts is one of the pressing problems of modern surgical dentistry.

As the analysis of literature data showed, the outcome of resection and removal of radicular cysts is not always favorable, more often there is the spread of stitches, infection, which, in turn, prolongs the recovery time [1, p.45-47;2, p.5-10]. In addition, after removal of the cyst, the formation of bone regeneration often takes 1-1.5 years, and in large cysts, even longer.

Based on the foregoing, the search for new methods that accelerate the replacement of jaw bone defects with bone tissue and effective measures for the prevention of postoperative complications is relevant and requires further research.

### §1.2. Characteristics of osteoplastic materials used in surgical dentistry

Currently, the following types of bone-plastic materials are used in surgical dentistry:

1. Biological materials
2. Non-biological materials.

Regardless of the type of material used, they are subject to the following requirements:

1. Materials must be made from harmless materials;
2. Have a sufficient degree of resorption with subsequent replacement by bone tissue;
3. Have ease of sterilization;
4. Convenience in both inpatient and outpatient settings.

As is known, biological materials are the most optimal for use in clinical practice, however, the problem of biological compatibility of the tissues used

remains unresolved, in the case of resorption development, transplanted tissues to the site of surgery negate the clinical effectiveness of the performed reconstruction of the bone base.

The rapid development of organic chemistry has led to the creation of the latest synthetic materials - implants based on calcium-phosphate ceramics, such as bioglass (PerioGlass, BioGran), tricalcium phosphate (Vitlokit, Ceramit); based on hydroxyapatite (HAP) in combination with collagen, sulfate and/or calcium phosphate (Haspet), as well as sulfated glycosaminoglycan-kerate and chondroitin sulfate (Bioimplant) [34, p.17-18; 38, pp.33-38; 47, pp. 72-79; 51, pp.69-75].

The following materials are proposed for use as implants: teflon, silicone rubber, polymethyl methacrylate, graphite, dacron, vicryl mesh, aluminum oxide, sylastic, carbon composite material "Carbon - M," a complex in the form of teflon (pro-plate) and porous carbon [58, p.10; 59, 60, p. 86-87]. However, unfortunately, the materials used do not meet all the requirements, in particular, they do not have the necessary degree of biocompatibility. It should also be borne in mind that a rapid inflammatory reaction develops at the site of an artificial implant made of the aforementioned materials [61, pp.63-68].

Materials for bone plastic surgery made from biological materials include auto, allo, and xenotransplantation materials [63, p.94-95]. As early as the 67-70s of the last century, xenotransplants - peritoneum, bladder mucosa, bone and cartilage transplants, bladder mucosa, xenogenic bref, and collagen, which were obtained from various tissues, were used to fill the bone cavity of operated cysts. The main disadvantage of these materials was their high antigenicity, the development of various postoperative complications, up to rejection, which led to ineffective use in practical medicine [64, pp.30-46;66, p.115].

Also, some researchers have proposed material in the form of ground muscle tissue with antibiotics, followed by spongiosis. The use of this method was justified by stimulating the restoration processes of cellular structures with residual products of muscle fiber breakdown [69, p.40;67, p.62-64]. However,

further practice has shown that transplanted muscle tissue remains are necrotized, instead developing connective tissue, which in turn leads to disruption of bone architecture [74, p.35-40;75; 76, pp. 149-152].

Subsequently, when filling the defects, autotransplants in the form of bone chips or fragments of the bone part of the ribs or wing of the ilium began to be used, which made it possible to quickly form new bone formations that completely replace bone defects [51, pp.69-75; 52, p.26]. However, it was also found that in some cases, rapid resorption of the established transplant occurred [53, p.2-8; 54, pp.227-232]. Recently, an autograft from a fragment of the bony skull dome has been used. The advantages of this type of autograft are the similarity of the bone base structure of the cranial vault and lower jaw, and the possibility of surgical intervention without laparoscopic access.

The introduction of new technologies, video and microsurgical equipment into clinical practice has made it possible to form fragments of viable bone tissue on the feeding vascular pedicle, and the size and shape of the scraps can be of varying complexity. In cases of maxillary defect, the anterior wall of the maxillary sinus can be used [78, p.129-130; 79, pp. 149-151; 81, pp.3-11; 84, pp.15-30]. However, in such cases, the development of transplant necrosis is possible due to thrombosis of the blood vessels of the feeding limb of the transplant, as well as the duration of the surgical intervention.

Allotransplants such as formalized, lyophilized, frozen, boiled, and decalcified bone tissue are also widely used [87, p.2691]. This type of autograft can be used as a fragment or bone gravel, ultimately stimulating bone formation processes.

At the stages of fragment preparation, particularly its sterilization, the destruction of the osteoinductive component of the transplant occurs, which is the cause of the formation of an immune conflict [34, p.17-18; 43, p.4-8], and according to some researchers, in 10-35% of cases, this is precisely the reason for rejection of the established allotarnsplant [43, p.4-8]. Another disadvantage of allograft is the rapid absorption of the established autograft; therefore, their use

is recommended for segmental subperiosteal defects of the mandible [37, p. 16-25; 38, pp.33-38; 39, pp.296-299], in other cases, this is unjustified.

During the demineralization process of the material used, changes occur in its structural organization and shape, all of which affect its elasticity degree under mechanical load. When preserving demineralized bone in a 0.25% formalin solution, the degree of osteogenic properties of the transplant significantly decreases, which subsequently leads to the development of an inflammatory reaction despite the presence of a bacteriostatic effect [41, p.29-31]. This is the reason for the complexity of its preparation, preservation, transportation, and storage, especially for a long time [45, p.117-120; 49, pp. 133-142; 90, p. 470-485; 93, pp.333-340].

Modern developments in osteoplastic materials include biogenic materials, which are created based on collagens and their derivatives. Collagen itself is a fibrillar protein of connective tissue, has no toxic and carcinogenic properties, low antigenic activity, and easily forms complexes with the medications used [41; 43, pp.25-28;56, pp.35-37].

A number of authors claim the effectiveness of using preparations based on solubilised collagen from cattle dermis [50, p. 47]. However, with the development of a purulent process, collagen structures rapidly break down [2, p.8-15; 56, pp. 35-37; 4, pp. 84-87]. Currently, collagen preparations in combination with bone meal are used in the treatment of periodontitis [4, p.84-87; 5, p.16-18].

The idea of using collagen preparations in combination with mineral formations based on hydroxyapatite and tricalcium phosphate is very interesting. As is known, hydroxyapatite is part of the hard tissues of the tooth, is an essential component of inorganic substances in bone tissue, and one of its main advantages is its biological compatibility with human tissues. When an implant based on hydroxyapatite is inserted into the affected areas of bone tissue, osteointegration of the «bone-bonding» type occurs [22; p.118; 24, p.64], while no connective tissue capsule is formed around the implanted allograft.

The data of the conducted studies on the introduction of cells in vitro onto

the surface of the hydroxyapatite base, their subsequent transfer to the tissue structures of experimental animals, are very interesting, and it turned out that this gave impetus to the further differentiation of this cell culture into osteoblasts. As a conclusion, it is precisely this GAP compound that has both direct and indirect effects on the producing bone structures [96, p.25-30; 100, p.540; 104, pp. 46-52]. Also, researchers incubated a culture of gingival tissue fibroblasts, which also had a direct effect on proliferation processes. According to the Chin-Brostrom theory, the main mechanism of action is the formation of free calcium ions during the dissolution of hydroxyapatite salts, which allows for the further synthesis of protein with RNA transcription.

Due to the many shortcomings of biological tissues, constant search is underway for materials used in bone grafting. These include silicon-containing compounds of the alumina type (bioceram, leucosapphire, corundum, etc.); materials made of various forms of carbon (graphite, carbine, etc.) and other types of implanted ceramic materials. Various types of synthetic hydrogels have also been proposed as flexible implantation materials. Also, metal implants continue to be used in clinical practice due to their high biocompatibility [18, p.44].

Biological glasses (Bi-oGran, Ctravital, PerioGlass) are also used in clinical practice, however, they have less stability and a more pronounced tissue reaction compared to GAP [104, p.46-52;106, p.1-12], as well as rapid resorption.

When using a non-porous ceramic implant of the type - PermaRidg, Durapatite, Interpore 200, Osteograph/D, Calcitte, it is completely «sealed» by bone, while in the area of the installed material, osteogenesis processes proceed very slowly or do not occur at all [108, p.2175-2182].

Porous GAP ceramics of the Algipor type, Osteograph.LD, PHA Interpore 200), also possessing the properties of an osteoconductor, are more commonly used in granulated form. As restorative-regenerative processes develop, it proliferates with cellular elements of connective tissue, osteogenic growth occurs in the area of the bone defect walls, with subsequent proliferation into intergranular spaces. These properties formed the basis for the use of porous ceramics as a sur-

face coating for endoprostheses and dental implants for osteosynthesis [6, 215p.; 9, p.16-19; 109, pp. 766-772; 110, pp.329-339].

Of great practical interest is the use of a solid calcium phosphate ceramic base as a conductor for conducting contour plastic surgery during osteoplastic surgeries - restoring the anatomical integrity of the facial skeleton's hard core after injuries or deformations, pronounced atrophy of the alveolar processes of the jaw bones [112, p.3-8; 113, pp.108-118].

Recently, the use of complex compounds in the form of synthetic polymers in combination with antibacterial agents in the treatment of inflammatory processes in bone tissue has become promising. For example, «Sentapal» is a complex of polymethyl methacrylate with gentamicin in the form of balls, which is used in the treatment of osteomyelitis [4, pp. 84-87; 23, p.113; 27; p.232].

There was also an attempt to use GAP as a guide to antibiotics in bone defects of the jaw bones, with the affected areas of the rats' jaws. Studies have shown that by the end of the 1st week, the maximum concentration of the antibiotic is detected in the bone tissue, while by the end of observation (12 weeks), more than 70% of antibiotics remain unbound, i.e., almost 5 times higher than the required concentration of the antibiotic [43, p.25-28; 57, pp.51-54].

The combination of GAP with a ceramic base is effectively used in the surgical treatment of periodontal diseases, replacing bone defects in the upper and lower jaws after removal of cysts, even with mobile teeth [61, p.63-68; 62, pp. 87-89; 63, pp.94-95), reconstructive operations on alveolar processes [55, pp.62-69].

GAP-based special membranes have also been developed for dental implants that fill bone defects. Membranes based on GAP in combination with finely ground autosuce or purified collagen.

The research of T.S. Khamraev (2015) proved the effectiveness of using GAP in granulated form based on ceramics. The GAP granules were packaged in a collagen and carbylan mesh case, which were installed in the subperiosteal layer of the defect. Furthermore, studies have shown that the implanted bone is

fixed to the cortical layer of the jawbone by germinating through granules of connective tissue cords, the basis of which is formed by osteoblasts of the periosteum, while the number of postoperative complications decreases [69, p.40].

Data on the use of the Kolapol KP-3 GAP plate in closing the floor of the maxillary sinus during its perforation, restorative plasty of the atrophied alveolar process, and surgical treatment of the periodontium are of interest [73, p.26-29; 74, pp. 35-40; 75, p.1]. At the same time, already in the first three months after plastic surgery, bone regeneration is observed, complete recovery is observed by the end of the first year of the postoperative period.

As the analysis of scientific periodicals showed, a fundamental breakthrough occurred in the implementation of new treatment methods in maxillofacial surgery and surgical dentistry by using new materials instead of traditional bone transplantation allogenic materials. This is primarily due to the development of new synthetic materials based on hydroxyapatite (HAP), tricalcium phosphate, and their combinations. These materials are non-toxic, safe to use, and have low allergenicity. Another feature is the possibility of «adding» various compounds to this base in the form of antibiotics, other active compounds, i.e., it can change its form depending on the treatment task. By changing the size and shape of the GAP crystal lattice particles, its reactivity can be modified, thereby improving its ability to restore osteointegration processes.

The specific surface area increases due to the presence of micropores, which leads to an increase in its biological activity of the preparation and the speed of its delivery to the object. The use of GAP-based biocomposite materials in combination with various medications leads to an acceleration of reparation processes, thereby effectively influencing wound healing processes during bone grafting.

Despite the availability of data on the use of new materials in osteoplastic operations, many questions regarding the choice of a particular type of material, its impact on bone tissue regeneration processes remain debatable and require further research. Also, the focus remains on the issues of comparative assess-

ment of the shape and size of bicomposite material particles that influence tissue regeneration and the course of the entire postoperative period.

**§1.3. Features of changes in tissue growth factors in the dynamics of osteoreparation processes and their combined use with other osteoplastic materials.**

As is known, growth factors play an important role in the processes of proliferation and regeneration of various tissue structures, which participate in the regulation of these processes, having a direct effect on various types of cells - fibroblasts, osteoblasts, epithelial, cementoblasts, etc., by influencing tyrosine kinase receptors [115, p. 10941-10953].

Platelet growth factor (PDGF) was isolated from platelets and subsequently detected in activated fibroblasts and macrophages. The isomeric form of PDGF consists of 2 polypeptide chains, having 3 forms in the form of monodimer AA, monodimer BB, and heterodimer AB. Research conducted by Parkar et al. (2001) revealed that PDGF A and B dimers are found in the gingival epithelium, and PDGF A stimulates postoperative wound healing processes in the early stages, while PDGF-B is involved in the process in the later stages of regeneration [117, p.474-478; 119, p.313]. However, when PDGF is destroyed by the elastase enzyme, the protein fraction of the extracellular matrix is destroyed, exacerbating the course of periodontitis [117, p.474-478; 119, p.313].

In studies by Matsuda et al. (1992), interesting results were obtained for a comparative assessment of the human platelet growth factor in a complex of other growth factors, in particular, TGF-p, IGF-1 and EGF for fibroblasts of the dental ligaments. It turned out that PDGF has a pronounced effect on the stimulation of collagen synthesis by the synthesis of collagen by PDL cells [Boyan et al., 2014].

Thus, plasma enriched with platelets contains high concentrations of growth factors and is capable of stimulating wound healing. Thrombocytes act as a transport medium for these factors, which can be used to restore bone tissue.

The addition of EDTA (ethylenediaminotetraacetic acid) enhances the proliferation of periodontal ligament cells [120, pp.10-12;121, pp.627-630], and the mitogenesis of cementoblasts, which are essential for the regeneration of periodontal tissue structures, particularly the periodontium [Saygin et al., 2020].

In chronic periodontitis, the synergism of PDGF and other growth factors increases, leading to an increase in osteoblast metabolic processes and regenerative processes in the periodontal tissues. The combined introduction of growth factors into bone defects led to the stimulation of bone tissue regeneration processes.

Thus, the work of Menini M et al. (2015) proved that a complex of PDGF-BB and IGF-I factors contributed to the rapid healing of bone defects [123, p.24999-25007].

Practical interest lies in the data of Panteleev V.D. et al. (2015) on the use of rhPDGF-BB in combination with 3-tricalcium phosphate, where this compound serves as a base matrix that contributes to better fixation of the implanted transplant. All of this combined leads to a decrease in the inflammatory reaction in the gingival tissue structures and improvement of bone regeneration processes. This became the basis for its use in the surgical treatment of periodontitis.

During the analysis of wound fluid in patients of this group, a biological substance - pyridinoline (ICTP), cross-linked with type I collagen, was identified, which made it possible to use it as a biomarker of bone tissue in the early stages of its regeneration [123, p.24999-25007; 125, pp.1227-1240].

Comprehensive treatment data showed that it is the platelet growth factor - PDGF that stimulates the growth and development of cementoblasts and other proliferating periodontal cells, thereby activating regeneration and repair processes [129, p.55-65].

Transforming growth factor P (TGF-P) belongs to the group of polypeptides involved in the regulation of embryogenesis, inflammation, immune response, regeneration, and wound healing processes [131, p.16-19; 132, pp.101-103].

According to recent studies, in particular, Roberts (2000), the following forms of this growth factor were identified - TGF-PI, TGF-P2, TGF-P3. These forms of TGF-R are synthesized by many immunocompetent cells - macrophages, fibroblasts, thymus cells, and platelets. In this case, the affected periodontal tissues mainly contain TGF-P2 and TGF-P3 [133, p.75-81]. The action of this growth factor TGF-R occurs through I and II type serine-threonine kinase receptors [125, 197-204;121, pp.627-630;119,313 p.].

As can be seen from the presented review of modern scientific periodic data, the mechanism of action of the transforming growth factor P - TGF-P directly depends on its combination with other growth factors, the population of immunocompetent cells, and the specifics of the implanting compound used.

### §1.4. Use of plasma enriched with platelets in combination with osteoplastic materials.

The success of surgical treatment of periodontitis, as well as the outcome of osteoplastic operations, depends on many factors, but one of the most important factors is the intensity of bone tissue regenerative processes. As is

known, bone tissue undergoes changes with age, bone resorption increases, and all this negatively affects the state of all tissue structures. In particular, all quantitative parameters of the maxillary sinus walls, especially its thickness, decrease [26, p.54-59; 27.232s; 28, pp. 196-205]. The consequence of these processes is the failure of installed dental implants [29, p.40-43;30, p.34-36;31, p.11-17]. Consequently, surgeons face the task of increasing the thickness of the sinus wall, while using autologous bone is the most optimal solution to this problem [33, p.4-8;34, p.17-18;36, p.751].

In the regulation of bone tissue development and formation processes, growth factors, as well as stem cell populations and extracellular matrix, play an important role [41]. And according to the conclusions of these authors, it is precisely the combination of growth factors and autotransplants that allows for the activation of regeneration and osteointegration processes.

The source of growth factor (GF) synthesis and secretion is platelets, among which it is necessary to distinguish the p-transforming growth factor (TGF-p), which actively participates in the synthesis of bone tissue morphogenetic protein - BMPs. According to many researchers, this protein is the main regulator of osteoregeneration processes [42, pp.64-67; 45, pp. 117-120; 46, pp. 40-43].

As processes in platelets are stimulated, growth factors - GFs - are released from α-granules, which in turn trigger regeneration processes [47, p.72-79; 49, pp.133-142].

A method for using platelet-enriched plasma (PEN) to activate bone tissue regeneration processes during operations in the maxillofacial region was developed by Marx et al. (2018). As the author indicates, it was the mixing of autologous platelet-enriched plasma with the used transplant that led to a significant improvement in bone regeneration indicators against the background of accelerated healing of soft tissues. In 2000, Kassolis et al. used platelet-enriched plasma in combination with a lyophilized bone graft during sinus elevation [91, p. 4779-4812].

Experimental studies conducted on animals demonstrated the effectiveness of using OTP and transplants during bilateral and unilateral sinus lifting [91, p.4779-4812; 92, pp.1-28].

Ebadian B. et al. (2016) conducted a comparative analysis of the use of an autologous bone containing an ODP and the implant itself without an ODP as an implant. Studies have shown that it is TTP that is the main factor in stimulating regeneration and osteointegration processes, i.e., it is platelet-rich plasma that serves as a source of GFs.

Despite the above review, there are a number of researchers who critically approach the issue of using TPP, arguing for the lack of a generally accepted standard methodology for performing sinus lifting using platelet-enriched plasma [65, p.1445].

The results of studies conducted by a group of authors [59, p.56-68] are interesting, where patients of different ages with varying bone densities were used, while the main group consisted of patients aged 50-52, as it is at this age that bone tissue resorption processes begin. The results of this study, as well as the work of Rodriguez et al. (2003), showed an increase in bone density by an average of 32-36%. OTP in combination with Bio-Os was used as a transplant. However, effectiveness is achieved only in the long-term periods of observation (6-7 months after surgery).

Currently, in surgical practice, the method of using ODPs in the surgical treatment of intraosseous defects of various origins is used [65, p.1445; 70, p.48]. However, the results of the study of bone density and histological data showed only a short-term effect. Similar results were shown in studies by other authors, whereas in the long-term periods of observation, no significant difference is observed between areas with and without transplants with TPP [72, p.49-53]

Consequently, the use of ODP and its combination with other osteoplastic materials requires further research to create an effective integrated material, the component of which is ODP.

## §1.5. Use of antiseptic and antibacterial drugs as methods for preventing complications after cystctomy

As is known, surgical interventions in the oral cavity are classified as conditionally clean surgeries, and the possibility of contamination of the oral cavity with pathogenic microflora is not excluded [5, p.16-18; 10, pp. 199-204].

Since pathological microflora is present in the cystic cavity, the cavity is filled with purulent-cystic discharge. After cystctomy, treating the cavity with antiseptic solutions does not always give a positive result.

Antibacterial drugs have taken an important place in the treatment of various diseases [2, p.7-11], and antibiotics are often used as a prophylactic agent [4, p.84-87; 10, pp. 199-204; 16, p.121c]. This is justified when performing osteopathic surgery in patients at risk of developing infectious endocarditis, immunodeficiency, etc. [18, p.48].

However, according to many researchers [Miller, 2020] the excessive prescription of antibiotics and, unfortunately, the attraction of patients leads to the depletion of the body's protective properties, the appearance of antibiotic-resistant microorganisms leads to an increase in patient treatment costs, an increase in allergic diseases among the population [1, p.45-47; 2, pp.5-10]. According to WHO forecasts, in the next decades, resistance to antibacterial drugs will become one of the global problems of the global healthcare system.

The prescription of antibiotics during surgical interventions in the oral cavity varies in different countries, for example, in India, more than 80% of dentists prefer to prescribe antibiotics even to healthy patients for prevention. Meanwhile, in Middle Eastern countries, only half of practicing dentists begin taking antibiotics to prevent the development of complications in the postoperative period [Abu Karaky, 2021; Warreth, 2022].

Among the various classes of antibiotics, the most commonly used are penicillin drugs (82-85%), among which the most commonly prescribed are drugs - amoxicillin or its combination with clavulanic acid. Some researchers prescribe these drugs as prophylactic agents when installing dental implants. Al-

so, among the frequently prescribed drugs, antibiotics of the quinolone series (about 20%), cephalosporins (15-18%), macrolides (4.5%), and lincosaminoglycans (1.5%) can be distinguished [22, pp.134-137; 27, p.232; 39, pp.296-299]. However, it should be noted that antibiotics should only be prescribed to determine their sensitivity [American Dental Association, 2003].

The data of S. Renvert (2016) on the use of special microspheres with minocyclin and chlorhexidine in the treatment of peri-implantatitis are very interesting. The study results showed that patients taking «Minocycline» significantly reduced the depth of periodontal pockets and gingival bleeding compared to «Chlorgexidin.»

The results of a study by S. Renvert et al. (2016) on assessing the effectiveness of the antibiotic mynocycline in bone tissue resorption are of interest. In the observation dynamics, it was revealed that when periodontal pockets were probed after taking antibiotics, the depth of the pockets improved significantly - from 5.1mm to 4.3mm, and bleeding symptoms decreased from 80% to 42%, respectively. The antimicrobial index showed a significant decrease in the strains of periodontopathogenic microorganisms starting from the second week after treatment, and this effect persisted until the third month of observation [73, p.26-29; 75, p.12; 76, pp. 149-152].

The use of periodontal tetracycline fibers as a local treatment for periimplantatitis suppresses Actinobacillu sactino-mycetemcomitans, Prevotellaintermedia, Porphyromonasgingivalis, and Tannerel-laforsythia [94, p.164-171], which, in turn, leads to the activation of restorative processes in periodontal tissues [95, p.5-12].

### §1.6. Use of bioactive glass in dental practice

Bioactive glass and glass ionometers are materials based on silicate mixtures that have the ability to interact with bone tissue.

Bioactive glass is a hard, bioinert material, first described in the early 1970s, and has been used in clinical practice since the early 1980s. Bioactive glass contains sodium oxide, calcium, phosphorus pentoxide, and silicon dioxide, the latter

being the main weight component. The formula of bioglass can be modulated by changing the proportions of the elements included in its composition - sodium oxide, calcium, and silicon dioxide. By increasing or decreasing the proportion of sodium oxide, the solubility of bioglass in the body can be regulated [11, p.47-55; 12, p.302]. Bioactive glass combines osteointegrative and osteoconductive properties.
The strong bonding of bioactive glass with bone tissue is due to the fact that bioactive glass, upon contact with the fluid of the bone environment, forms a gel layer saturated with silicon on its surface. The interaction of Ca2+ and (PO4) 2 ions in the gel forms hydroxyapatite (Hg) crystals, which have the same crystal lattice as the Hg of bone tissue, which is due to the strength of the compound [10, pp.199-204; 12, p.302; 17, p.132].

Bioactive glass blocks are poorly subjected to mechanical processing, under extreme load - drilling - the block breaks down, which complicates the block's fixation on bone tissue. The use of granulated bioglass as a bone defect filler is permissible only in limited areas that will not subsequently be subjected to stress; there are also materials that surpass CG in terms of resorption rate, contributing to the earlier restoration of the bone defect [20]. This clearly indicates that bioglass is inferior to other materials mentioned in this work, but bioglass has a field of application where it is quite effective: applying bioglass to the surface of a titanium implant significantly accelerates its osseointegration [23].

One of the varieties of bioglass is bioactive ceramics, which surpasses bioglass in strength and mechanical properties, but, like bioglass, is inferior to the cortical plate of bone tissue in its strength to break. This very property, combined with vulnerability to cyclical loads, severely limits the area of application of bioglass and biokeramics in dentistry.

Glass ionometers

The introduction of glass-ionomer cements in dentistry began in the early 70s of the last centuries, when there was a need for a material capable of hardening and retaining strength characteristics in humid environments. One such cement serving to fill bone defects is described in the work [16, 121p.]. This cement is a

finely dispersed glass containing silicon, calcium, aluminum oxides, and fluorosilicates. The working solution is produced by mixing the cement itself with polycarboxylic acid - this initiates an exothermic reaction (CO2↑) leading to the formation of a porous cement paste. The setting time of cement is within 5 minutes, after which the cement mass becomes insoluble in water. During the hardening period, the cement mass should be isolated from oral fluids: dilution of polycarboxylic acid with liquids reduces its concentration and ability to fully react with cement, which negatively affects the mechanical properties of the finished cement mass.

Glassionomer cement is a biocompatible material capable of osseointegration and, in a number of parameters, comparable to bioactive glass. The porous structure of the cement mass gives it osteoconductive properties, promoting bone tissue growth, but this material does not resorbe and cannot replace its own bone.
Over the past 25 years, various bone-replacing materials have been developed in Uzbekistan and Russia to eliminate complications after cystctomy, one of which is «Bioactive glass» [2, p.5-10; 66, p.48; 27.232 p.].

Numerous experimental and clinical studies by domestic and foreign authors have been devoted to the scientific substantiation of its application and the search for further ways to improve it.

The main problem that arises before the surgeon-dentist when planning to restore the dental arch is the insufficient number and poor quality of the bone in the proposed implantation zone. After cystctomy, bone restoration significantly decreases and leads to atrophy of the alveolar process of the jaws, in turn, bone atrophy is the main limiting factor in planning dental implantation.

# CHAPTER II. MATERIALS AND METHODS OF EXPERIMENTAL AND CLINICAL RESEARCH

## §2.1. Material and methods of experimental research

To solve the set tasks, an experimental study was conducted, dividing the experiment into 2 groups - control and main. In the main group, we used the composite bone-plastic material we recommended (Composition: biologically active glass (BS) - weight%: SiO2 40.08 - 46.06, MgO 8.75 - 8.96, CaO 28.66-30.44, P2O5 6.22-7.19, CaF2 5.65-5.79, Na2O 4.49-4.59 and B2O3 0-5.16). In the control group, the main structural components of the «OsteonTM II» composite bone grafting material were (two-phase calcium phosphate filled with 30% hydroxyapatite + 70% β-tricalcium phosphate) + natural (bovine) type I collagen. Cylinder dimensions: 6x5 mm or 6x10 mm. Due to its properties and characteristics, the bone graft has the potential to create definitive bone tissue. The criteria for selecting a composite bone transplant material were its following characteristics:

1. Covering the transplant surface with collagen contributes to its stronger fixation in the wound surface and cavity walls;

2. The plasticity of the structure allows it to be easily applied to the entire surface of the defect, which significantly reduces the time of the surgical intervention stage;

3. After some time, the applied collagen layer completely dissolves in the surgical wound.

Experimental and morphological studies of the domestic bone replacement material (bioactive coating) for its medical and biological safety were conducted in the laboratory of the Scientific and Practical Center of Stomatology and Maxillofacial Surgery of the Tashkent State Dental Institute.

The experiments were conducted in strict accordance with the International Ethical and Scientific Standards for the Quality of Planning and Conducting Research on Animals TIC 125-2008 (02040).

The experiment used 30 Shinshilla rabbits of both sexes with a body weight of 4200-4300 g, kept in vivarium conditions on a standard diet, taking into account the provisions of the international convention on «Rules for Working with Experimental Animals» (European Communities Council Directives of 24 November 1986, 86/609/EEC) and in accordance with the requirements of ISO 1099311-2011 «Medical Products. Assessment of the biological effect of medical devices. Part 2 - Requirements for Animal Management». Observation of the animals' general condition and behavior was conducted for 14 days before the start of the experiment and for 7 days after the start of the experiment. 14; 21 days and 1; 2 months after surgery.

Before conducting the research, the animals were weighed, their appearance, and activity were assessed.

Experimental animals were operated on to model a non-translucent bone defect in the area of the mandibular angle, as this area is most optimal in terms of the structure of the dense bone and body of the mandible as the average density of the human bone.

According to the objective of this study, all experimental animals were divided into 2 groups of 15 individuals each:

1. Control group (n=15). In this group of animals, the defect of the formed trepanation opening in the area of the mandibular angle was closed using an «OsteonTM II»plastic material, which includes an osteoconductive bone graft (OSTEON II) + type 1 natural collagen.

2. The main group (n=15) - in this group, bioactive glass was used as an osteoplastic material in combination with OTP (platelet-enriched plasma) and lincomycin was added.

In the control group, after moistening, the osteotransplant became plastic, fit tightly, and spread easily across the defect surface; after placing the fragment in the defect area, the collagen shell opened. The defect replaced by osteotransplantation was sutured layer by layer with soft tissue thread («Vicril» 3,0). The surgical wound was covered with a sterile gauze bandage.

In the main group, after the administration of BS in combination with OTP (platelet-enriched plasma) and a wet antibiotic (linkomycin), the osteotransplant became porridge-like, the cavity was easily filled to the surface of the defect, then the defect was layered with soft tissue thread («Vicril» 3,0). The surgical wound was covered with a sterile gauze bandage.

Course of the operation. 30-40 minutes before the operation, all animals underwent premedication with 2 ml of a 1% dimedrol solution and 0.4-0.5 ml of atropine sulfate solution. Surgical interventions were performed under intravenous anesthesia: freshly prepared etaminal sodium solution was administered into the ear vein at a dose of 40 mg/kg, then after deep sleep, 0.5% novocaine solution was administered locally under the skin. After removing the fur at the site of the future operation and treating the skin with an iodine-alcohol solution aseptically, 4-5 cm incisions were made on the skin, followed by a cut of the muscle layers. By dissecting the skin and muscle segment, access to the angle of the lower jaw was obtained. In the area of the mandibular angle, a defect of the same shape and size (0.5x0.5x1 cm) was created using a 1 mm diameter drill with a rotational speed of 1000 rpm, irrigated with physiological solution. Then, in the control and main groups, the created artificial defect was filled with osteoplastic materials OsteonTM II and BS in combination with OTP+linkomycin, respectively. After filling the defect during suturing, standard layering technique was used.

Observation of the general condition of laboratory animals was carried out hourly during the first 24 hours of the experiment, and once a day during the subsequent 90 days of the experiment. During all periods of the experiments, clinical signs of possible intoxication were recorded: the general condition of the animals, feed and water intake, body weight dynamics (every three days), behavior characteristics, coordination, intensity and nature of motor activity, reaction to external stimuli, frequency and depth of respiratory movements, condition of fur and skin, and color of mucous membranes.

In the dynamics of the experiment, X-ray examination of the implant site was conducted at 7, 14, 21 days, 1 and 2 months after implant placement.

Experimental animals were isolated from each group at 3 individuals during observation periods of 7, 14, 21 days, 1 and 2 months after surgical intervention by inhalation anesthesia. For this purpose, a lytic dose of «Isofuran» was used until the animal's heart and breathing completely stopped.

### §2.1.1. Morphological Research

During the experiment, the defect area was visually examined in each animal, and the presence of residual conglomerates and signs of soft and bone tissue hypertrophy in the area where the osteoplastic material was applied was determined. Material sampling was carried out from the areas of the defect wall, the site of the proposed osteintegration. Subsequently, the selected lower jaw biomaterials were fixed in a 10% neutral formalin solution for 24 hours, followed by transfer to increasing concentrations of alcohols. De-calcination was carried out using trichloroacetic acid, after the piece was washed with 90% alcohol. To prepare histological preparations, the decalcified bone material was poured into paraffin. Hematoxylin-eosin and orsein were used to stain cuts of decalcified bone tissue. The process of reparative osteogenesis was assessed under the «OPTIKA» microscope (Italy).

## §2.2. Material and methods of clinical research

At the Tashkent State Dental Institute, the Surgical Stomatology Polyclinic, a total of 96 patients were examined, of which 50 patients (52.1%) with radicular cysts, as well as 46 patients (47.9%) with chronic periodontitis outside the acute phase, who were shown preparation for cystctomy.

The study included patients diagnosed with radicular cyst accompanied by jaw bone tissue resorption and patients diagnosed with «chronic periodontitis» outside the acute phase, who were planned to restore the lost bone.

Of the 96 patients, 53 were male patients, 43 were female patients aged 21 to 65 years, without pronounced somatic pathology.

To include patients in this study, we developed the following requirements:

1) the presence of the patient's written consent to participate in this study;

2) absence of concomitant somatic pathology at the time of examination or presence of somatic pathology in the compensation stage;

3) age of patients from 21 to 65 years;

4) satisfactory oral hygiene status according to the conducted dental examination.

The following criteria served as the refusal to be included in the group:

1) active smokers (more than 10 cigarettes a day);

2) comorbid somatic pathology at the stage of exacerbation;

3) having a history of mental illness, drug addiction, alcoholism;

4) older age group;

5) pregnancy, breastfeeding;

6) the presence in the anamnesis of periodontal diseases, sinusitis, the detection of foreign bodies in the maxillary sinus, neoplasms of the jaw bones;

7) blood diseases, disorders of hematopoietic function: lymphogranulomatosis, leukemias, hemolytic anemias, thalassemia;

8) the presence of oncological diseases in the given anatomical and adjacent regions;

9) chronic somatic diseases of the body: diabetes mellitus, diseases of the oral mucosa, diabetes with insulin dependence, rheumatic disease, tuberculosis;

10) pathologies of the bone system that create insurmountable obstacles to the normal regeneration of bone tissue: congenital osteopathy, osteoporosis, dysplasia, osteonecrosis;

11) diseases of the oral mucosa: Sjögren's syndrome, lupus erythematosus, pemphigus, chronic recurrent aphthous stomatitis;

12) Patients who were diagnosed with CNS pathology.

The patient's refusal to further participate in the study, identification of pregnancy or previous illness at the time of the study, and violation of the treating physician's recommendations served as a refusal to further participate in the study.

All patients were examined at the clinic of the Tashkent State Dental Institute, which included collecting anamnesis, conducting radiological examinations, blood laboratory tests, and consultations with relevant specialists if necessary. The operation was performed according to plan under infiltration or conduction anes-

thesia with articaine. The age of the patients ranged from 21 to 65 years.

Groups were formed depending on the material used to fill the jaw bone defect (Table 2.1). Before surgery, patients underwent psychological preparation, emphasizing the necessity of introducing an OTP (platelet-enriched plasma) and antibiotic (linkomycin) into the grooves and cavities of maxillary defects to accelerate wound healing, the importance of preserving the shape of the alveolar process and, accordingly, restoring impaired functions, and preventing various pathologies of the dentoalveolar system.

*Table 2.1*

**Distribution of patients by type of material used in the bone defect area**

| Group No. | Material | Number of patients | | |
|---|---|---|---|---|
| | | Total | M | F |
| I | БС в комплексе с ОТП и антибиотиком | 36 | 20 | 16 |
| II | Osteon$^{TM}$ II | 28 | 16 | 12 |
| III | Blood clot | 32 | 17 | 15 |
| Total: | | 96 | 53 | 43 |

*Distribution of patients by study groups.* Depending on the osteoplastic material, patients were divided into the following three groups:

The first group consisted of patients who underwent cystectomy using a sandwich technique, and the following components were layered on the bottom of the treated bone defect: the first layer - lincomycin powder, the second layer - bone-plastic BS microgranules, the third layer - platelet-rich plasma.

The second group also consisted of 28 people (16 men and 12 women). In all patients of this group, the cystic cavity was filled with OsteonTM II.

The third group consisted of 32 people (17 men and 15 women), all patients of the III group underwent cystectomy without implantation of any materials.

Regardless of the method used to fill the bone defect, antibacterial, antihistamine, and antifungal therapy, NSAIDs, and eubiotics were prescribed to all patients. Also, local oral baths with antiseptic solutions, cold in the area of the oper-

ated defect. The criteria for the effectiveness of the osteoplastic materials used in the treatment dynamics were the results of clinical, gnatomyometric, densitometric, and radiation research methods.

To study the severity of osteointegration processes, all studies were conducted both before treatment and at various stages after surgery (15 days, 1, 3, and 6 months after surgery).

## §2.3. Dental research methods

Ambulatory records (form 043/U) were filled out for all patients on the day of their initial appeal. In the outpatient card of the dental patient, in addition to the mandatory passport data, the complaints presented were recorded; the patient's life history data (conditionally, past and concomitant diseases, allergological history). The results of the standard dental examination, the dental formula, the data of additional examination methods prescribed as needed, the main and accompanying diagnoses (if complications are detected) were recorded separately.

Clinical examination was conducted using traditional methods and consisted of questioning, clarifying complaints, and clinical examination of the patient.

Complaints:

- the presence of pain sensations in the oral cavity depending on mechanical, temperature, and chemical irritants, or the presence of independent pain;
- mobility and/or displacement of the tooth/tooth with exposure of the neck and roots of the teeth;
- presence of an unpleasant odor from the mouth;
- change in gingival color;
- presence of a fistula tract in the gingival margin with pus discharge.

Immediately before the start of surgical treatment, patients underwent general blood analysis, biochemical analysis for HIV, hepatitis, and syphilis. In case of detection of any somatic pathology or various complications, patients were referred to the relevant specialist to clarify the diagnosis and prescribe adequate treatment.

Patients with severe somatic diseases were mandatorily excluded from the study plan.

A mandatory condition was careful control of oral hygiene (by both the patient and the doctor themselves), consent to the operation from a general practitioner. During the survey, special attention was paid to the appearance of the first signs of the disease, its nature, and duration. If possible, previously taken X-rays, results of previous treatment, and oral hygiene status were studied. External examination and palpation of regional lymph nodes (mental, submandibular, cervical) were performed.

The examination of the oral cavity was conducted according to the generally accepted scheme. During the examination of the oral mucosa, the degree of moisture, color, signs of swelling, and other morphological elements of the existing pathology were determined. The presence of carious or filled teeth was taken into account separately. Hyperemia and swelling of the transitional fold, presence of fluctuation, degree of tooth mobility, presence of a fistula, and purulent discharge from the fistula tract were determined.

On the eve of the surgical intervention, all patients were assessed for the hygienic condition of the oral cavity and the presence of jaw bone destruction - based on clinical examination data and radiation examination results.

The results of the medical examination are indicated in the reporting documentation - form 043/U «Ambulatory card of the dental patient». Based on the examination data, patients with a history of severe somatic pathology in the acute stage and decompensation stage were not included in the study plan. It should be noted that when patients were found to have CHPVC pathology, they were also excluded from the observation group.

At the preoperative stage, all patients underwent the following analyses:

1) general and detailed biochemical blood analysis;

2) coagulogram;

3) detection in the blood of patients of antibodies to the viruses of HIV, hepatitis B, hepatitis C, RW;

4) fluorography.

Only after completing the necessary examinations, as well as obtaining written consent for participation in this study, was surgical treatment performed.

### §2.3.1. Clinical assessment of patients' condition after surgery

Within the framework of this study, we developed criteria for the effectiveness of the surgical treatment, which are: the severity of collateral edema, hyperemia of the wound area of the mucous membrane, and most importantly, the intensity of pain sensations.

Observation periods and clinical examination of the operated patients were 1, 3, 5, 7, and 10 days after the surgical treatment.

*Criteria of pain syndrome intensity.*

This indicator corresponds to the generally accepted Numerical Rating Scale (NRS), taking into account the indicators of subjectivity in the patient's pain perception according to Brevik H. et al. (2008). The developed scale consists of 11 indicators (Table 2.1):

*Table 2.2.*

**Degree of pain sensation**

| Points (in figures) | Intensity indicator |
|---|---|
| 10 | very intense pain |
| 7,8,9 | severe pain |
| 4,5,6 | moderate pain |
| 2,3 | mild pain |
| 1 | barely noticeable pain |
| 0 | no pain sensations |

The assessment of pain sensations after surgery was conducted on days 1, 3, 5, 7, and 10, taking into account the quantity and dosage of the analgesic medication taken.

*Assessment of the severity of collateral edema.*

The degree of swelling was also expressed in points, with the same observation periods (Table 2.3.).

*Table 2.3.*

**Degree of collateral edema severity**

| ***Points*** | ***Severity of collateral edema*** |
|---|---|
| 0 | absent |
| 1 | weakly expressed |
| 2 | moderately expressed |
| 3 | strongly expressed |

*Evaluation of the degree of mucosal hyperemia in the postoperative wound area.*

Hyperemia of the mucous membrane in the postoperative wound area was assessed using a point system during observation periods - 1, 3, 5, 7, 10 days after the surgery (Table. 2.4).

*Table 2.4.*

**Severity of mucosal hyperemia**

| ***Points*** | ***Intensity of mucosal coloring*** |
|---|---|
| 0 | pale pink color of the mucous membrane |
| 1 | mild hyperemia |
| 2 | moderate hyperemia |
| 3 | bright hyperemia |
| 4 | cyanosis |
| 5 | ischemia |

During a dental examination of the oral cavity using either the Periotest device or tweezers, the degree of tooth mobility was determined (Table 2.5):

*Table 2.5.*

**Tooth (or teeth) mobility index**

| *Degree* | *Tooth/teeth mobility index* |
|---|---|
| First degree | Tooth mobility in the range of 1-2mm in the vestibulo-oral direction |
| Second degree | tooth/tooth mobility in the range of more than 3 mm in vestibulo-oral and medio-distal directions |
| Third degree | tooth/teeth mobility in the range of more than 3 mm in all alignments (vestibulo-oral, medio-distal directions, as well as along the vertical axis) |

During the general clinical examination, we analyzed the following data: fever, fever, enlargement of lymph nodes, suture failure in the surgical wound area, hematoma, rejection of bone-plastic material, neurological symptoms, development of inflammatory processes, wound epithelialization.

As the research results were obtained, they were analyzed and recorded in the relevant documentation.

### §2.4. Conus-radial (3D radiological) examination

One of the objectives of this dissertation work was to assess the condition of tissue structures at various stages of osteoplastic surgery: before the start of surgical treatment, at the time of osteotransplantation, as well as in the dynamics of the postoperative recovery stage. Within the framework of this study, all patients at the time of initial access, as well as 2, 4, and 6 months after the postoperative period, underwent orthopantomography or intraoral contact radiography.

Based on the obtained results, we evaluated the qualitative indicators of the formed osteoregenerate, osteointegration processes, bone tissue growth indicators, and alveolar ridge width indicators after augmentation of the dental cavity using «OsteonTM II»and «Biosteklo» materials in combination with OTP with linkomycin.

Computed tomography was performed on a GE Revolution EVO device. Bone density and alveolar growth parameters of the jaw were determined using the Radian software.

### §2.5. Gnatodynamometric studies

In this study, it is necessary to keep in mind that the bite area of the gnatodynamometer should exceed the area of the tooth being examined; in this case, the sensation of pain is minimized. Further, after installing the device, the patient gradually compresses the jaws until pain appears in the dental periodontium. Measurement is carried out several times, while fixing the maximum value of the gnatodynamometer in conventional units according to the device's display. This study using a gnathodynamometer was performed on all patients, both before and after surgery, at 1, 3, 6, 9 and 12 months. In this case, we examined the central incisors and canines on both the affected and healthy parts of the jawbone.

### §2.6. Densitometric examination

The next stage of the study was the determination of the density of the newly formed bone fragment in patients after osteoplastic surgery for the plasty of the maxillary alveolar process. This study was conducted using Image J software (Wayne Rasband National Institute of Health, USA, http://rsb.info.nih.gov/ij). Densimetric measurements were carried out on the images - determining the difference in the brightness of pixels between different images in the form of normal areas, areas of formed bone fragments, and cystic formations. Since the image brightness depends not only on the density of the neoplasm but also on the state of the fixing apparatus itself, therefore, only relative data were calculated. The following formula was used to determine the relative density of bone tissue:

$$\text{Relative density} = \frac{\text{Average density value of the recess}}{\text{Average density value}} \times 100\%$$

Observation periods: before surgery, after 1, 3, 6, 9, and 12 months.

## §2.7. Methodology of surgical treatment

Patients were divided into 3 observation groups depending on the type of surgical intervention to fill the cystic cavity of the maxilla. Regardless of the type of surgery, the oral cavity was treated with a 0.05% antiseptic solution of chlorhexidine bigluconate for 1-2 minutes. Anesthesia was administered with a 1:200,000 ratio of articaine solution.

In the early postoperative period of treatment, the operated patients received complex antibacterial therapy, including: antibiotic «Amoksiklav» 625 mg, 1 tablet 3 times a day for 5 days; nonsteroidal anti-inflammatory drugs in the form of «Nimisil» 100 mg, 1 pack. 2 times a day; antifungal therapy in the form of «Flucosate» 150 mg, 1 tablet on the third day of antibacterial therapy.

It was also recommended to perform oral baths with a warm antiseptic solution of chlorhexidine bigluconate 0.05% for 1-2 minutes 3 times a day.

In the postoperative period, all patients were recommended:

- limiting excessive physical exertion;

- exclusion of massage, visiting saunas and baths, sunbaths, solar baths, compresses, baths, swimming pools;

- careful care of the wound surface.

To monitor the course of the postoperative period, patients underwent clinical examination on the 1st, 3rd, 5th, 7th, and 10th days after surgery.

### §2.7.1. Augmentation of jaw bone defect with «Bioactive glass» microgranules in OTP complex with antibiotic

After anesthesia of the surgical field using a 15C scalpel, a trapezoidal incision was made in the area of the transitional fold of the causative tooth, and then the mucosal-periosteal flap was removed from the vestibular surface using a raspatory. With the help of a bormashina, a window was formed in the apical region of the root of the causative tooth for access to the cystic cavity. After compact osteotomy, the granulation tissue was removed from the cystic cavity using a curettage spoon and a bleeding surface was created.

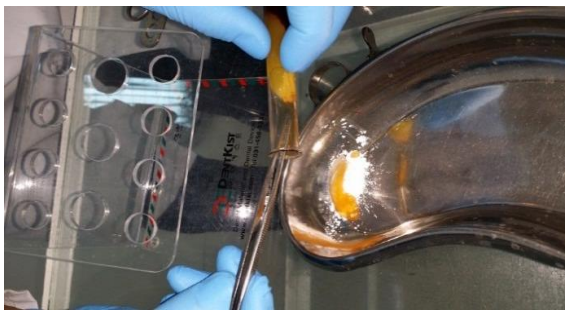


Fig. 2.1. «Bioactive glass» in an OTP complex with linkomycin.

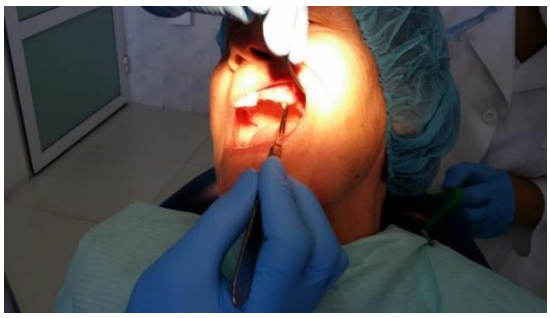


Fig. 2.2. The cystic cavity is filled with ostein- ductive material.

The selected osteoplastic material in a sterile container was mixed with a solution of antibiotic (linkomycin) and platelet-rich plasma. After moistening, the osteotransplant became porridge-like, the cavity was easily filled to the surface of the defect, then the defect was sutured to the soft tissues layer by layer with «Vicril» 3.0 thread (Fig. 2.2).

### §2.7.2. Augmentation of the cystic cavity using composite bone transplant material OsteonTM II.

A cut in the area of the transitional fold of the causal tooth is standard trapezoidal in shape, with subsequent removal from the vestibular surface of the causal tooth using a mucosal-periosteal resealer. Further, with the help of a bormashina, a window was formed in the apical region of the root of the causative tooth for access to the cystic cavity. After compact osteotomy from the cystic cavity, curettage of the cystic cavity was mandatory, with complete removal of the granulation tissue and formation of a bleeding wound surface.

The cystic cavity was filled with OsteonTM II composite bone transplantation material. The replacement had to fill the entire cystic cavity. Wound suturing was performed by applying interrupted sutures using non-resorbable monofilament suture thread (Figure 2.2).

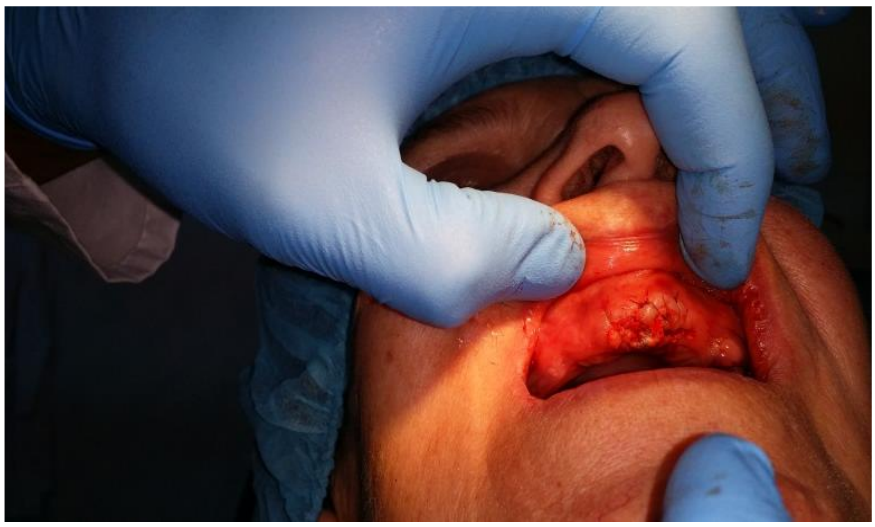


Fig. 2.3. The cystic cavity was filled with OsteonTM II composite bone transplant material, and the wound was sutured with interrupted sutures.

### §2.8. Microbiological and immunological research methods.

Microbiological studies were conducted in the clinical and microbiological laboratories of the III Multidisciplinary Clinic of the TMA. Material collection in the suture area of the surgical site was carried out using the standard method using a standard transport container with «Amiès» medium (Fig. 2.4).

The obtained material was delivered to the laboratory within 1-2 hours after the surgical intervention. To conduct a quantitative analysis of the oral mucosa microflora, at least 2 ml of oral fluid was collected from the operated patient.

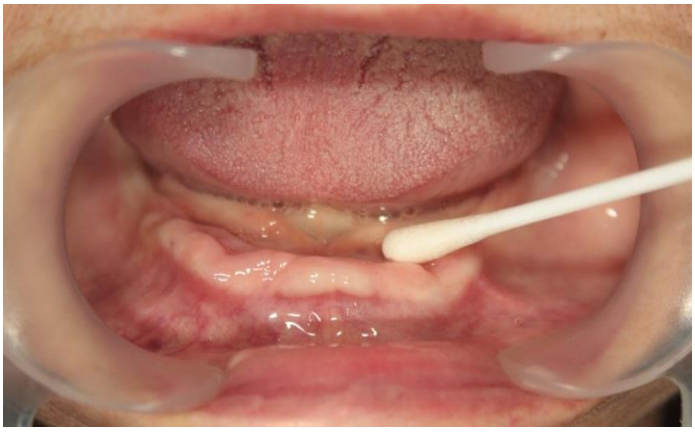


Fig. 2.4. Taking material for microbiological examination before the cystctomy operation

Further, to judge the effectiveness of the antibacterial therapy, a 0.9% sterile NaCl solution was added to the suspension of microorganisms from the grown cul-

ture colony. By comparing the purity of the microorganism suspension with McFarland's No. 1 turbidity standard.

The sensitivity indicator of a particular strain of microorganisms to various preparations is formed based on the values of the microorganism growth retardation zone diameter. The diameter of the microorganism culture growth delay zone is characterized by the absence of strain growth in the so-called «lightening» zones (2.5-figure).

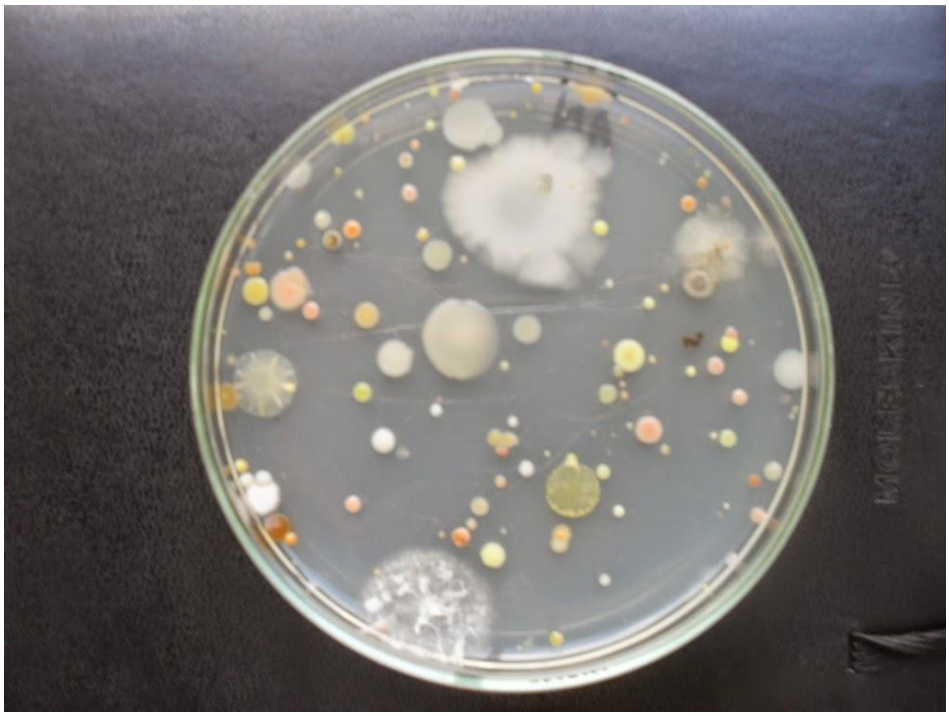


Fig. 2.5. Microbiological examination of oral fluid

For each strain of microorganisms, a specific type of agar was used:

1. for facultative anaerobic microorganisms - Givental-Vedymina agar (AGV);

2. for Candida spp cultures - Saburo agar;

3. for obligate-anaerobic cultures - Shedler agar,

0.1 ml of the prepared suspension of the microorganism culture was applied to the surface of the corresponding type of agar, which was evenly distributed across its surface using a sterile spatula.

After 30 minutes of drying at room temperature, disks impregnated with medicinal preparations were placed on the surface of the agar with the culture suspension, followed by incubation according to generally accepted conditions.

## ГЛАВА 3. CLINICS OF ODONTOGENIC CYSTES AND MODERN APPROACH TO THEIR TREATMENT.

### §3.1. Results of morphological data of experimental studies

In accordance with the stated goal and objectives of the study, a morphological study of the dynamics of reparative regeneration of the artificially formed area of the mandibular bone tissue defect after the use of composite bone grafting material was conducted, and a comparative characterization of morphological changes in different observation groups was provided.

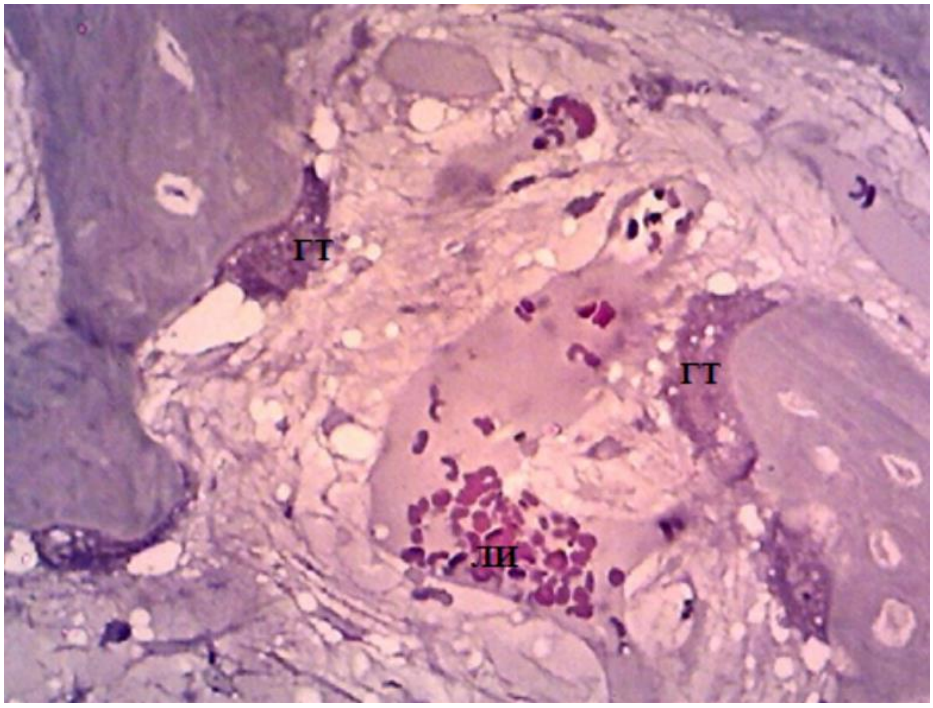



Fig. 3.1. 7th day of the experiment (control). Development of leukocyte infiltration (LI) and granulation tissue (GT) around the Hemoxylin-eosin defect. 200 level

The study results showed that already on the 7th day after filling the completed defect of the mandibular angle in the experimental animals of the control group, an osteogenic tissue proliferation with pre-formed cellular structures of bone tissue is observed in the area of the previously artificially created bone tissue defect (Figure 3.1), and the defect cavity itself is filled with the composite bone transplant material «Osteon II.» In the experimental group of animals, during these

observation periods, a loose mass of osteotransplantant is detected in the defect area, blood vessels located near the defect in the bone tissue areas penetrate into the osteotransplantant (Figure 3.2).

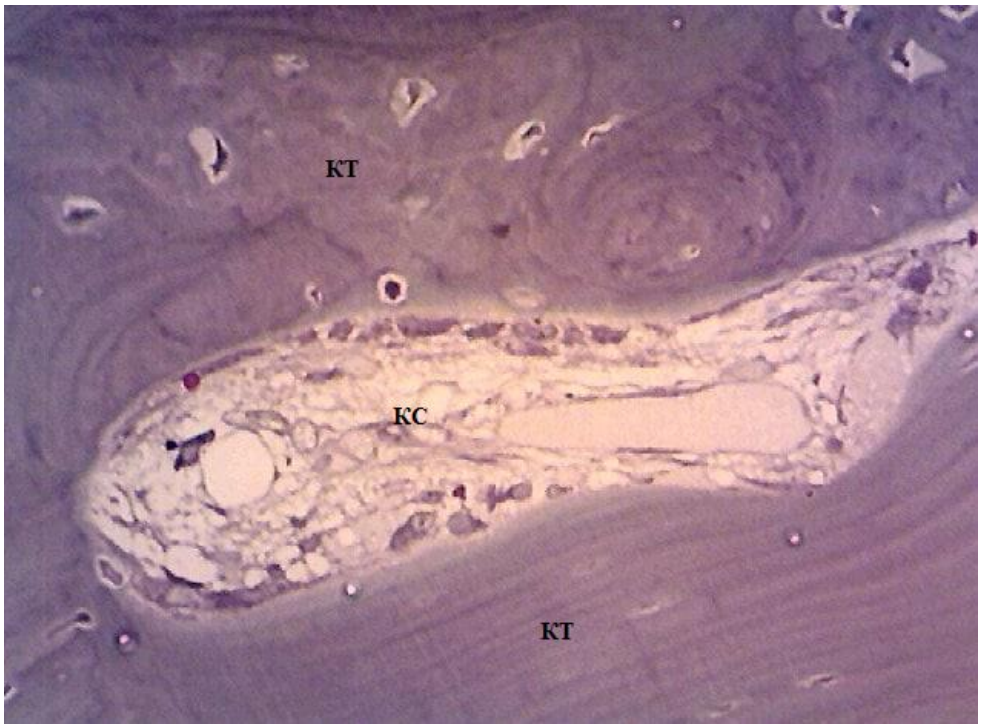



Fig. 3.2. Day 7 of the experiment (experiment). Blood vessels (BC) penetrating the bone graft (CT). Hematoxylin-eosin. 200 level

In subsequent observation periods, in the control group, instead of the used composite bone transplant material «Osteon II,» a network of soft connective tissue fibers appears, between which bundles of collagen fibers, single blood vessels, and fibroblasts are located, but no signs of bone formation development are observed (Figure 3.3).

In contrast, in the second group of experimental animals, formed bone trabeculae surrounded by a chain of osteoblasts are found in the defect zone. These formations are found near the blood vessels (Fig. 3.4), the interstitial space is occupied by osteoblasts and vascular cavities lined with endothelium.

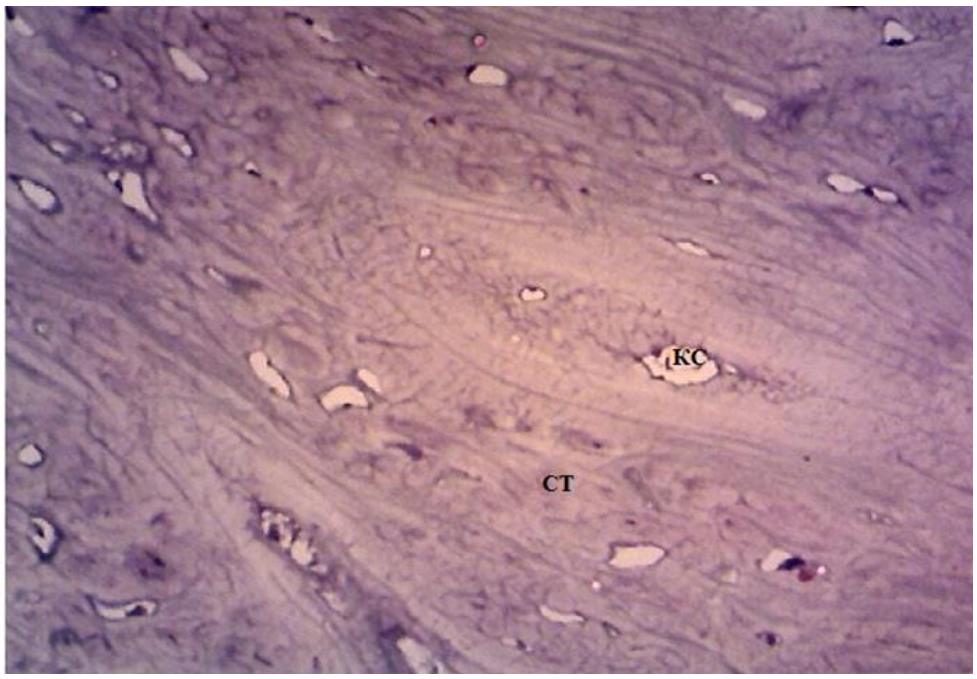



Fig. 3.3. Day 14 of the experiment (control). A thin layer of connective tissue (CT) forms around the blood vessels (BV). Hematoxylin-eosin stain. Magnification x300

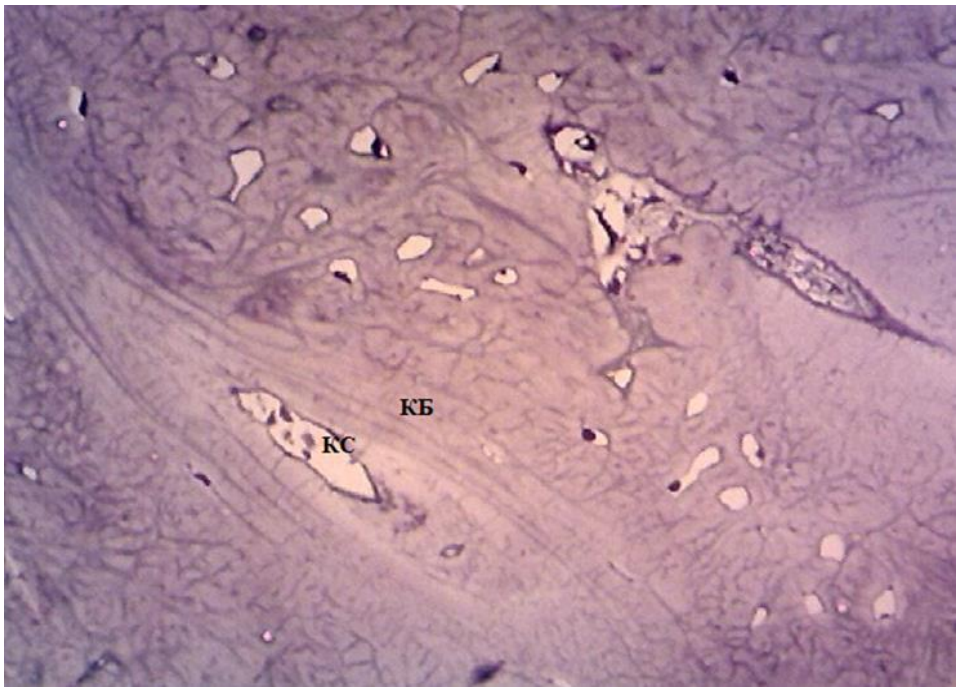



Fig. 3.4. Day 14 of the experiment (experimental group). Formation of concentric bone trabeculae (BT) around blood vessels (BV). Hematoxylin-eosin stain. Magnification 400x.

On the 21st day of the experiment, a zone of ossification in the form of tender young bone trabeculae is observed in the control group. Interstitial spaces have blood vessels around which osteoblasts are located (Fig. 3.5).

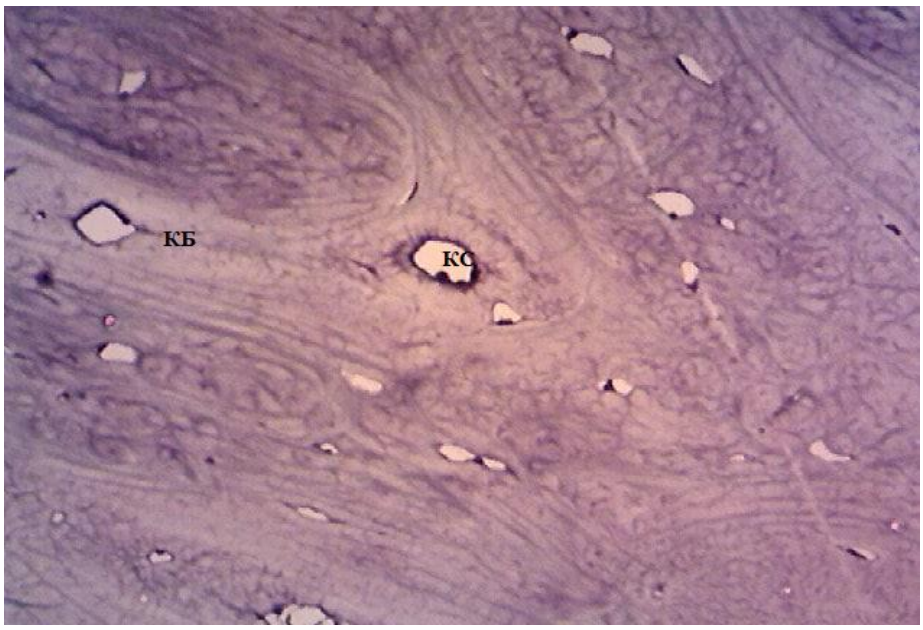



Fig. 3.5. Day 21 of the experiment (control). Formation of bone trabeculae (BT) around blood vessels (BV). Hematoxylin-eosin stain. Magnification 300x.

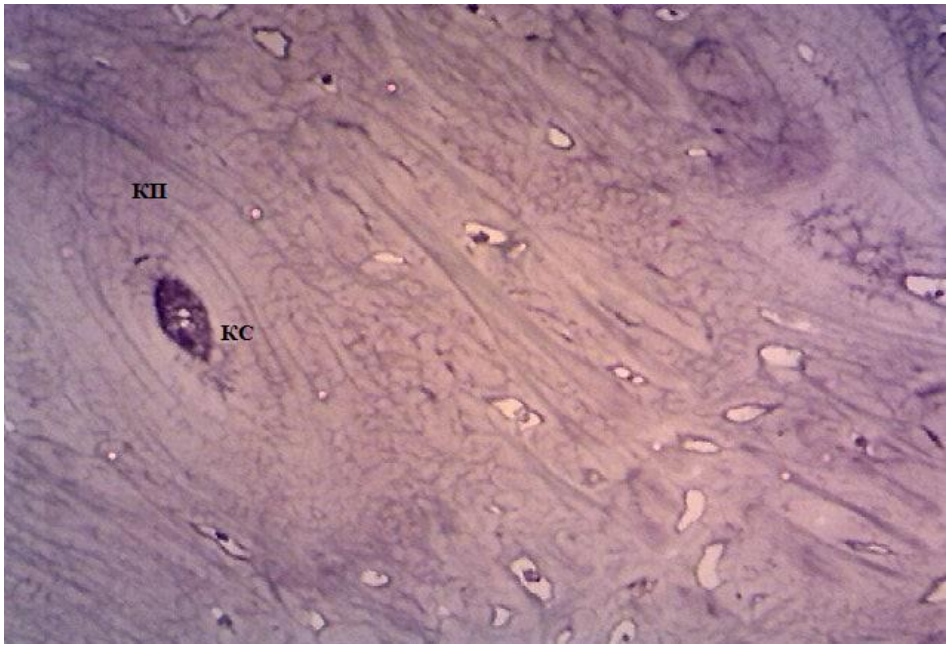



Fig. 3.6. Day 21 of the experiment (experimental group). Formation of compact lamellar bone tissue (CL) around blood vessels (BV). Hematoxylin-eosin stain. Magnification x100

In the experimental group of animals, the intensive process of osteogenesis continues during this period of the experiment. The bone trabeculae are more massive and are also located around blood vessels. The proportion of bone material decreases (Fig. 3.6).

By the 30th day of observation, the histological picture of osteogenesis processes in the experimental group of animals is more pronounced compared to the control group. There is evident replacement of the implanted osteotransplant with newly formed bone tissue in the form of mature bone elements. In some areas, delicate bone plates of the developing compact bone are observed (Fig. 3.8). In the control group, such a picture was not observed (Fig. 3.7).

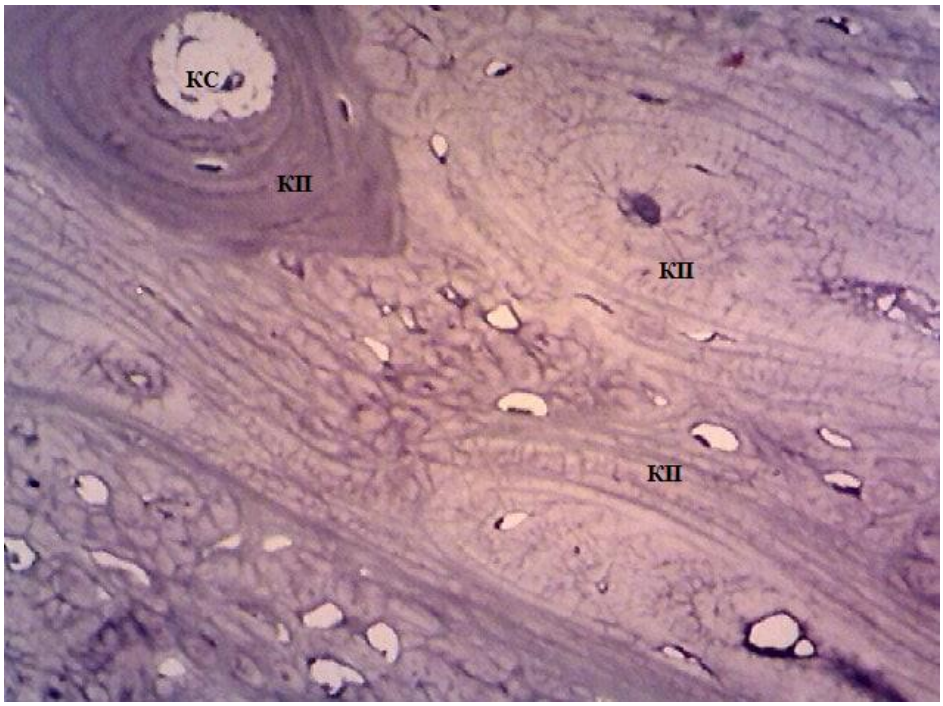



Fig. 3.7. Day 30 of the experiment (control). Increase in the percentage of concentric bone lamellae (CBL) around blood vessels (BV). Hematoxylin-eosin stain. Magnification 300x

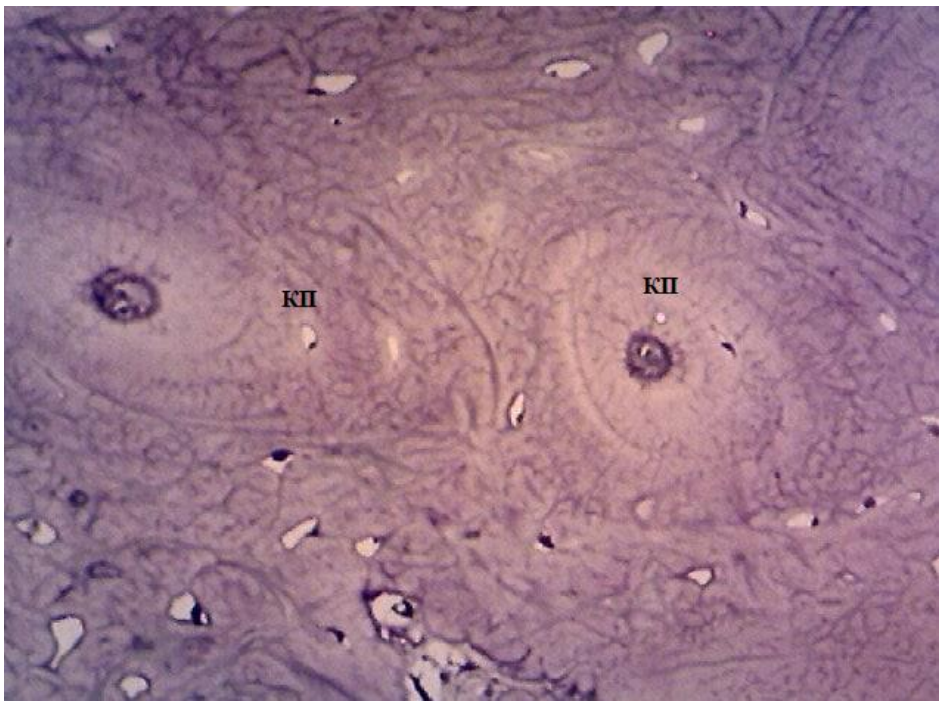



Fig. 3.8. Day 30 of the experiment. Formation of lamellar compact bone in the form of thin bone plates (BP). Hematoxylin-eosin stain. Magnification 100x

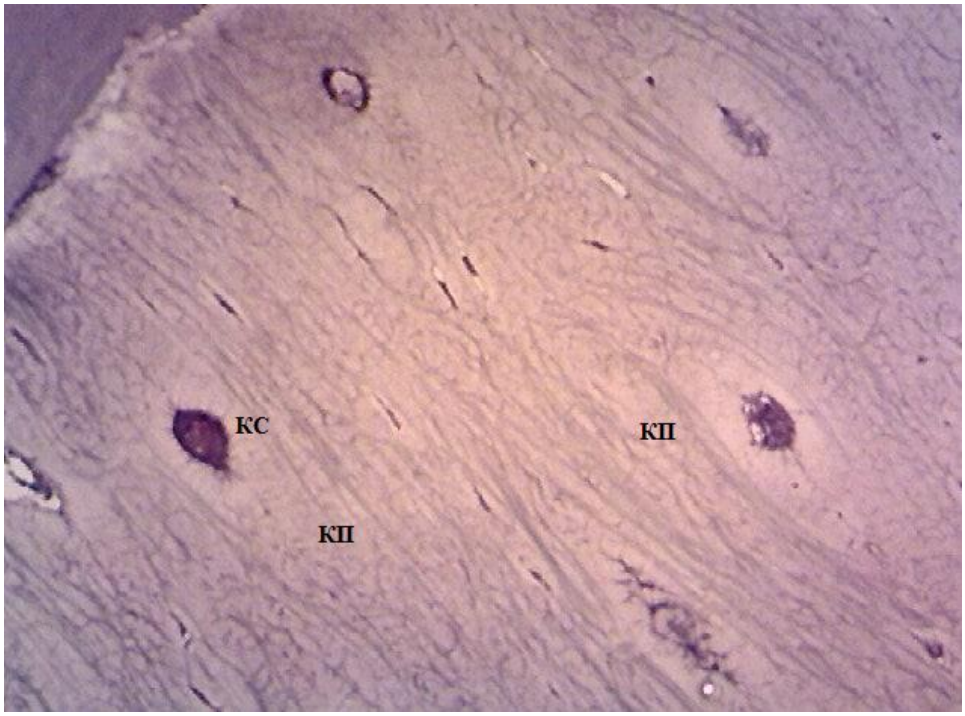



Fig. 3.9. Day 60 of the experiment (control). Formation of thin concentric bone lamellae (BL) around blood vessels (BV). Hematoxylin-eosin stain. Magnification 400x

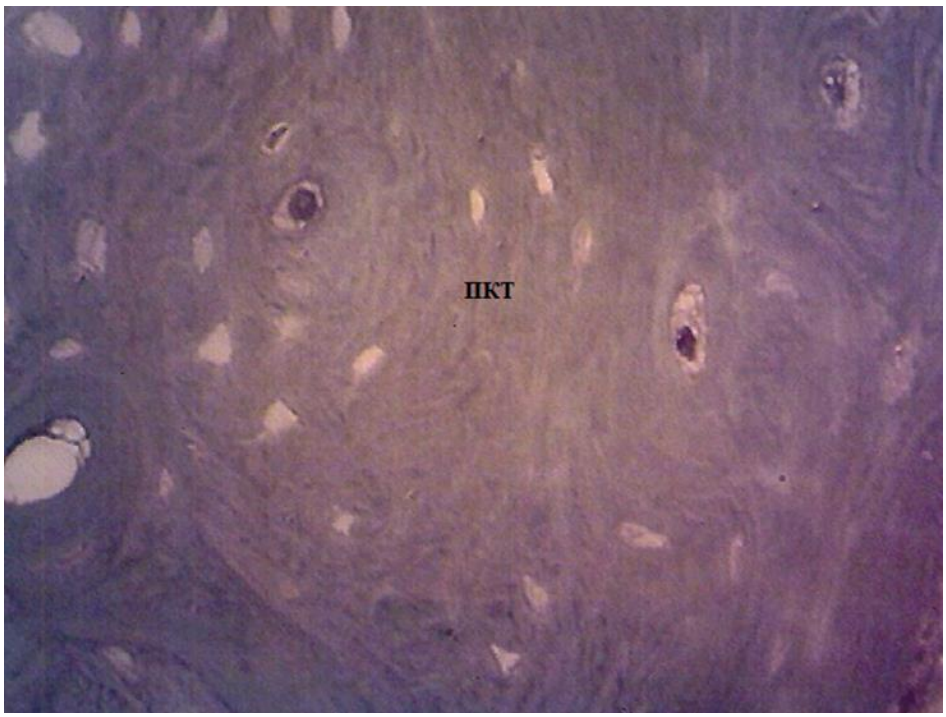



Fig. 3.10. Day 60 of the experiment. Fully formed lamellar bone tissue (LBT). Hematoxylin-eosin staining. Magnification 200x

After 2 months of the experiment, alternating trabecular and lamellar structures of bone tissue were observed in the defect area of the control animals. In some places, the bone tissue appeared as delicate bone trabeculae, in others as fully formed bone trabeculae, and in yet others as thin bone lamellae. This indicates the ongoing process of transformation from woven bone tissue to lamellar bone tissue (Fig. 3.9). In animals of the observation group, at this time, a unified mass of bone tissue was observed, which completely filled the defect. The structure of the newly formed lamellar bone tissue fully corresponded to the histological structure of the mandible (Fig. 3.10). It should be noted that it is during this period that complete fusion of the osteotransplant fragments with the main bone tissue was observed, with no visible boundaries between them.

### 3.2. General characteristics of patients included in the study plan

One of the objectives of this study was to evaluate the effectiveness of several osteoreparative materials in bone grafting operations to eliminate jaw bone defects, as well as after surgical treatment of chronic periodontitis and cyst removal.

The research results showed that the osteoreparative materials used possess certain proliferative and reparative properties, although each of them has different

rates of realizing these properties. It should also be noted that due to the aforementioned properties, the formation of new bone tissue occurs differently.

During this study, 96 patients underwent surgery. All patients were divided into three groups depending on the osteoplastic material used:

- Group I consisted of patients whose bone defects were filled with the osteoplastic material «Bioactive Glass» with lincomycin;

- Group II - patients with jaw bone defects, where the biocomposite material «OsteonTM II»was used;

- Group III (control group) - consisted of patients whose bone defects were filled simply with a blood clot.

In the experimental part of this study, we found that when filling a jaw bone defect with «Bioactive Glass» in combination with lincomycin and «OsteonTMII,» the processes of osteogenesis and the final formation of new bone tissue structures are noticeably activated compared to the results of healing under a blood clot alone.

When using these osteoplastic materials in the defect area, approximately the same histological picture of reparative processes was observed, with the defect cavity being filled with delicate, fine-fiber connective tissue, and the formation of capsule walls occurring. In some areas, polymorphonuclear cell infiltrates are detected in the bone tissue surrounding the filled defect.

By the 15th day of observation, activation of osteoreparative processes is observed in the areas of jaw bone defects, followed by the gradual replacement of the defects with immature bone tissue. Complete replacement of the defect occurs at later observation periods. In this case, a sealed cavity of the defect is formed, filled with newly formed bone tissue. This leads to the conclusion that the earlier the signs of osteogenesis appear, the more effective the components of the plastic material are. The materials used in our research are distinguished by the high effectiveness of the reparative osteogenesis process.

The use of osteoplastic materials such as «Bioactive Glass» in combination with PRP and antibiotics, as well as the preparation «OsteonTM II,» was justified

by the composition of these biocomposite materials, in particular, based on collagen and hydroxyapatite. As can be seen, it is these components that contribute to the activation of regeneration processes in the defective areas by forming connective tissue, on the basis of which the cellular elements of bone tissue will further develop.

### §3.2.1. Results of evaluating the effectiveness of treatment for patients with jaw bone defects without using osteoplastic materials

The control group consisted of 32 patients, including 18 men and 14 women. Patients underwent cystectomy with root apex resection, with 32.7% on the upper jaw and 10.8% on the lower jaw. Secondary bone defects in all patients of this group were closed under a blood clot.

As mentioned above, the control group consisted of patients whose jaw bone defects were simply filled with a blood clot. The study results showed that after cystectomy under the blood clot, regeneration processes begin, however, their progression is noticeably slow. Patients often experience wound infection, with inflammatory processes also affecting the surrounding tissues. All of this collectively leads to the search for additional treatment methods and the use of supplementary medications aimed at activating bone tissue repair and regeneration processes, reducing the intensity of inflammatory processes, and lowering the risk of developing various complications.

**Clinical Observation Protocol No. 1**

Patient K.P., 25 years old, outpatient chart No. 1462. Complaints of inflammation in the lateral part of the lower jaw and associated pain.

Objective findings: Hyperemia of the mucosa in the area of teeth 42-46, swollen and flattened transitional fold. Palpation reveals crepitation and crunching of the cortical plate in the area of teeth 42-46, tenderness on percussion.

X-ray: Focal bone destruction in the lower jaw, measuring 2x4 cm.

Diagnosis: Radicular cyst of the right mandibular body**.**

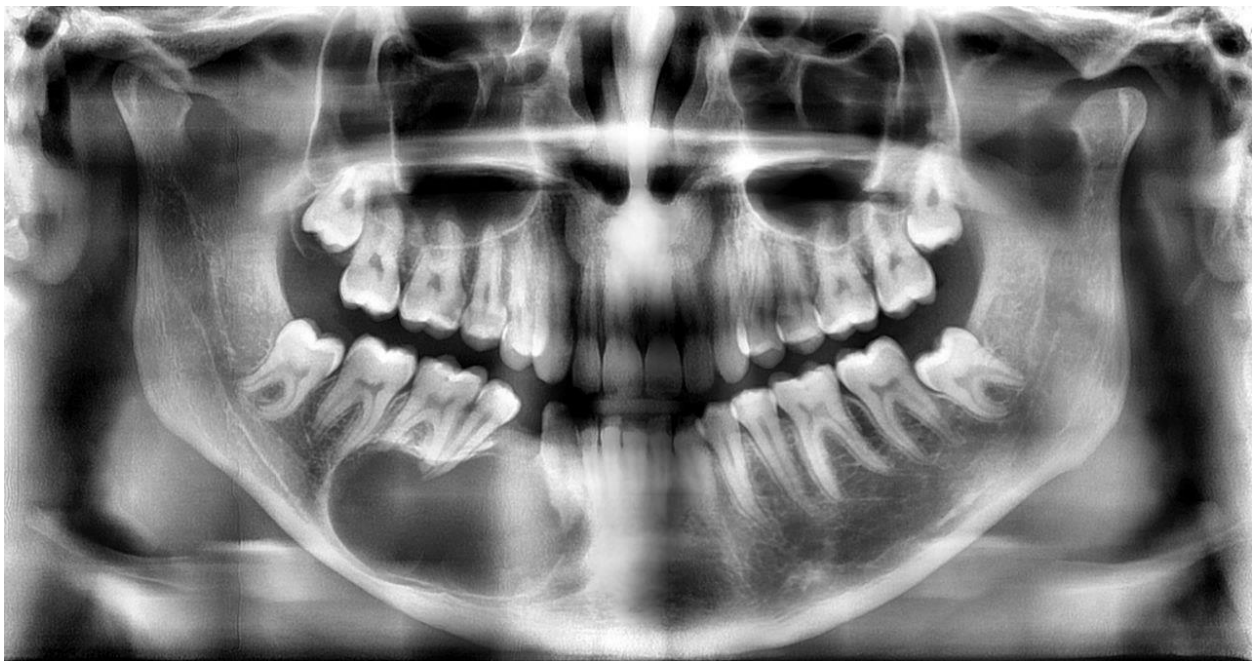


Fig. 3.11. Orthopantomograms of patient K.P. Lower jaw radicular cyst measuring 9x4 cm in the area of 42-46 teeth.

Treatment: Teeth 42-46 are depulped and filled. After this, the surgical stage of treatment is carried out. Operation technique: Following anesthesia, an incision is made along the dentogingival margin, then the mucoperiosteal flap is separated using a periosteal elevator. Using fissure and round burs under cooling with saline solution, perforation of the outer cortical plate is performed in the area of teeth 42-46. After opening the cystic cavity, 4-5 ml of fluid is aspirated. Then, after removing the cyst membranes, thorough curettage of the cystic cavity is performed using a curette. The cavity is irrigated with a chlorhexidine solution, the mucoperiosteal flap is mobilized, and the wound surface is closed. Interrupted sutures are applied using Vicryl 4.0. Externally - cold compress and pressure bandage for 12 hours.

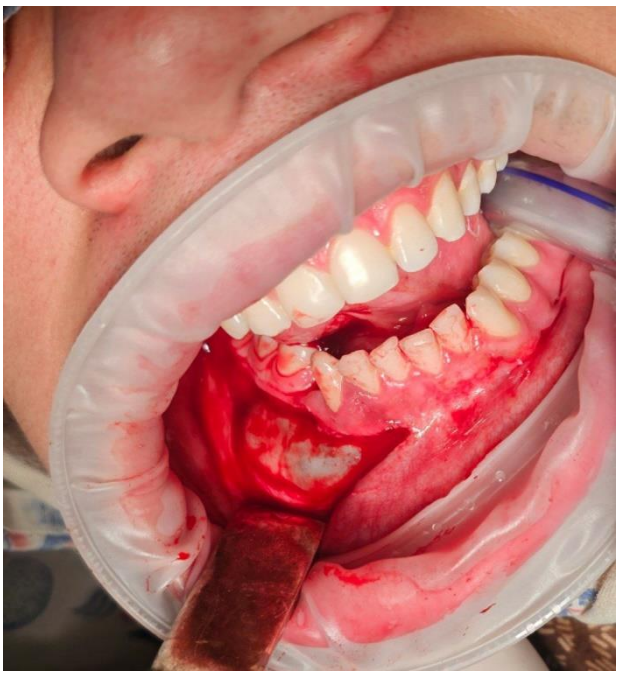


Fig. 3.12. Patient K.P. Oral view after incision

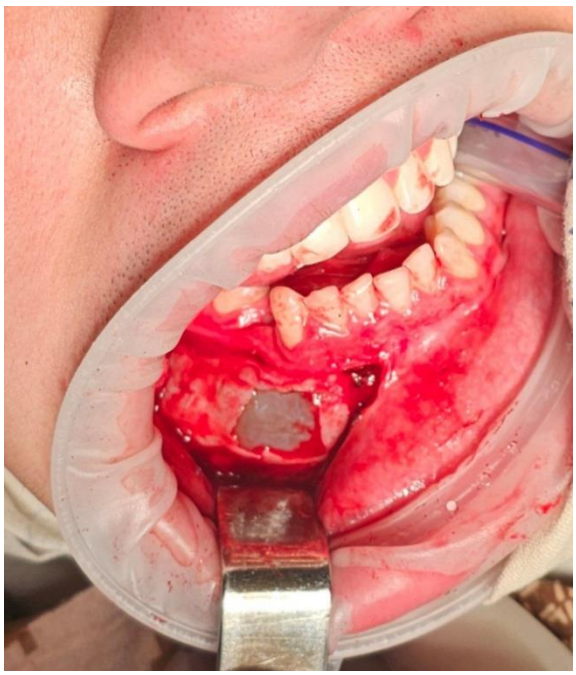


Fig. 3.13. The same patient. View in the oral cavity. Exposure of cyst membrane

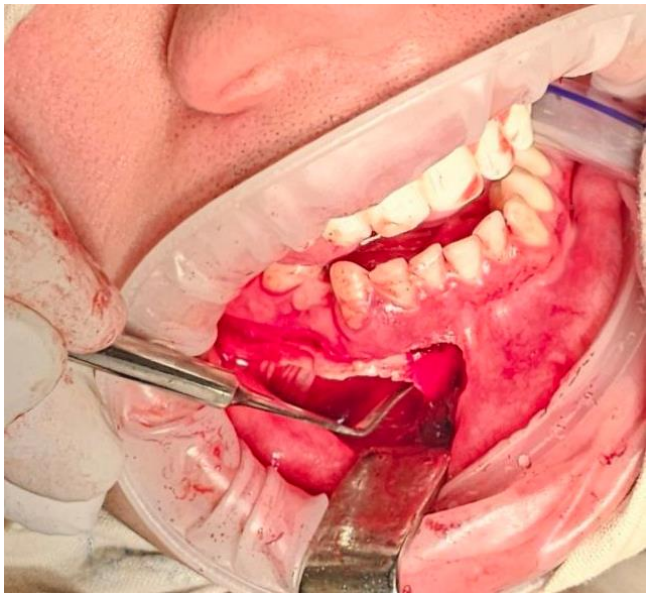


Fig. 3.14. Oral view. Removal of cyst membrane

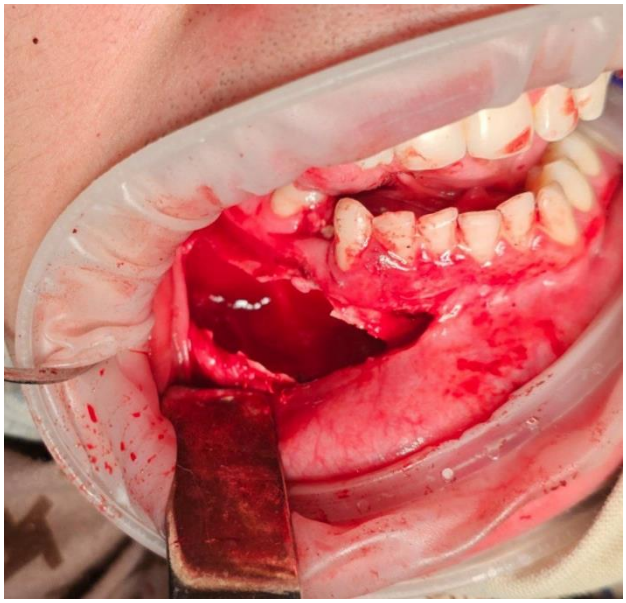


Fig. 3.15. Oral view.
Bone wound after removal of cyst membrane

Fig. 3.16. Excised cyst with its capsule

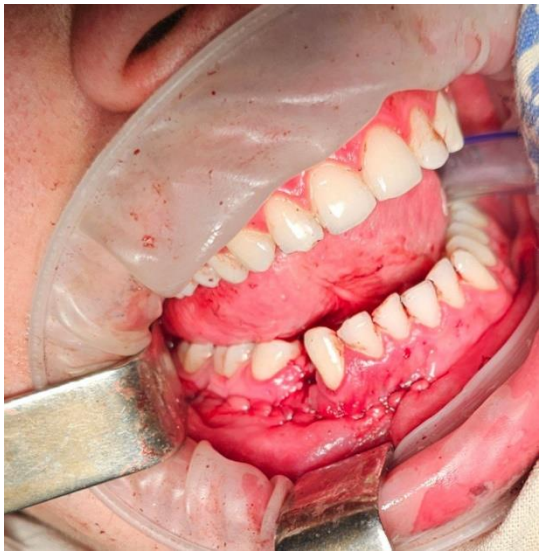


Fig. 3.17. Patient K.P. Oral view. Sutured mucosal-periosteal scrap

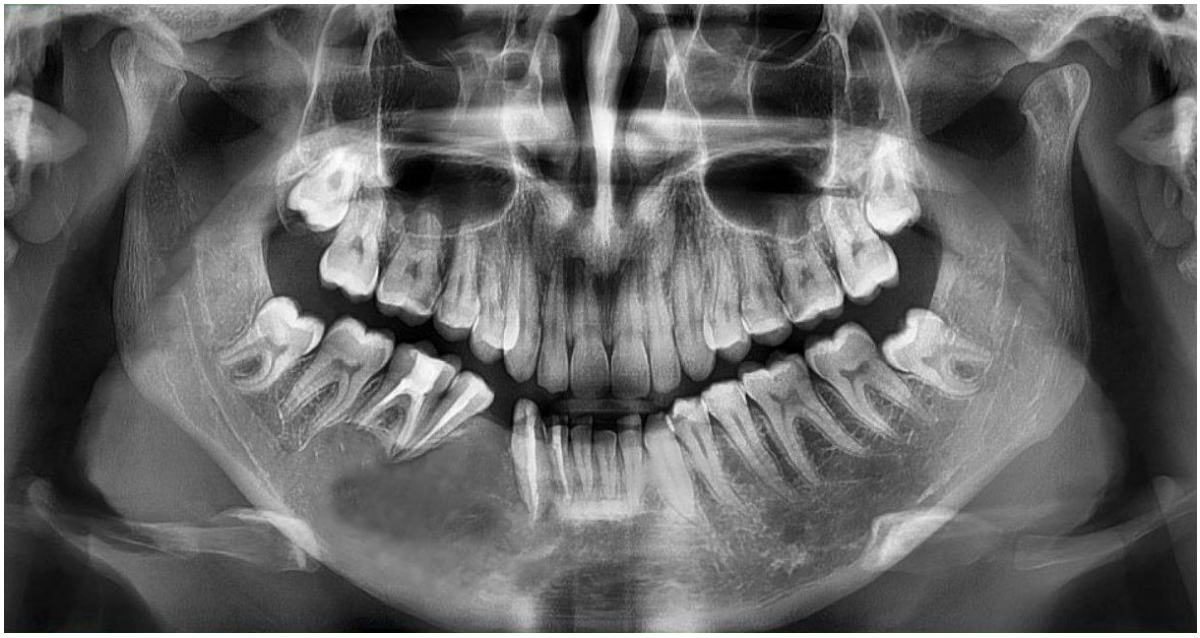


Fig. 3.18. Orthopantomogram of patient K.P. 12 months after cystctomy

After 12 months of cystctomy, areas of bone fragment regeneration are detected on radiographs, however, complete restoration of the defect does not occur (Fig. 3.18). Despite the preservation of bone defect boundaries, the radiograph of bone tissue structures in this area corresponds to the preoperative picture. Due to the suppuration of the blood clot, the patient was additionally prescribed a course of antibiotic therapy with drainage of the postoperative wound.

In the control group, more than 64.0% of patients experienced postoperative complications, including suppuration, wound dehiscence with soft tissue infiltra-

tion leading to fistula formation (more than 27.0%), and disease recurrence.

In 10.8% of patients in the control group, recurrence of the underlying disease was detected after 8-12 months. Complete restoration of bone structures in the defect area occurs only by the end of the second year of observation. In 2.5% of patients, the secondary defect was extensive, so complete restoration of the structures

**§3.2.2. Evaluation of treatment effectiveness in patients with jaw bone defects using osteoplastic material combined with an antibiotic**

The second group of patients consisted of those who received the composite bone graft material «Bio-active glass» in combination with platelet-rich plasma (PRP) and lincomycin during surgery. The research results demonstrated high efficacy of this osteoplastic material, especially for large defects. This is apparently related to resorption processes and osteointegration in the bone wound.

Analyzing the obtained results, we can conclude that the intensity of angiogenesis and osteogenesis with the formation of periosteal regenerate in the early stages of observation is similar to the course of regenerative processes in the control group, where patients' wound healing processes occur under a blood clot. However, at later observation periods (8-10 months), when using the «BS» osteoplastic material in combination with PRP and lincomycin, the intensity of new bone tissue formation proceeds more rapidly, and the pattern is almost identical to that of normal bone.

Additionally, when using the biocomposite bone graft material «Bioactive Glass» in combination with platelet-rich plasma (PRP) and lincomycin, the incidence of postoperative complications - symptoms of swelling, mucosal hyperemia, and inflammatory processes - significantly decreases compared to the control group.

***Clinical Observation Protocol No2.***

Patient S.R., 32 years old, dental outpatient chart No. 175/2. The patient's complaints upon admission: pain in the lower jaw area on the right side for 11 months.

Objective examination: the mucous membrane in the area of teeth 47-48 shows no apparent changes, the vestibular fold in this area is somewhat flattened. Palpation reveals crepitation and crunching of the cortical plate.

X-ray: in the area of the right mandibular angle, there is an image of rarefied bone tissue, a round formation with clear borders, measuring 3x4 cm (Fig. 3.19).

Diagnosis: Follicular cyst of the mandible in the area of tooth 48.

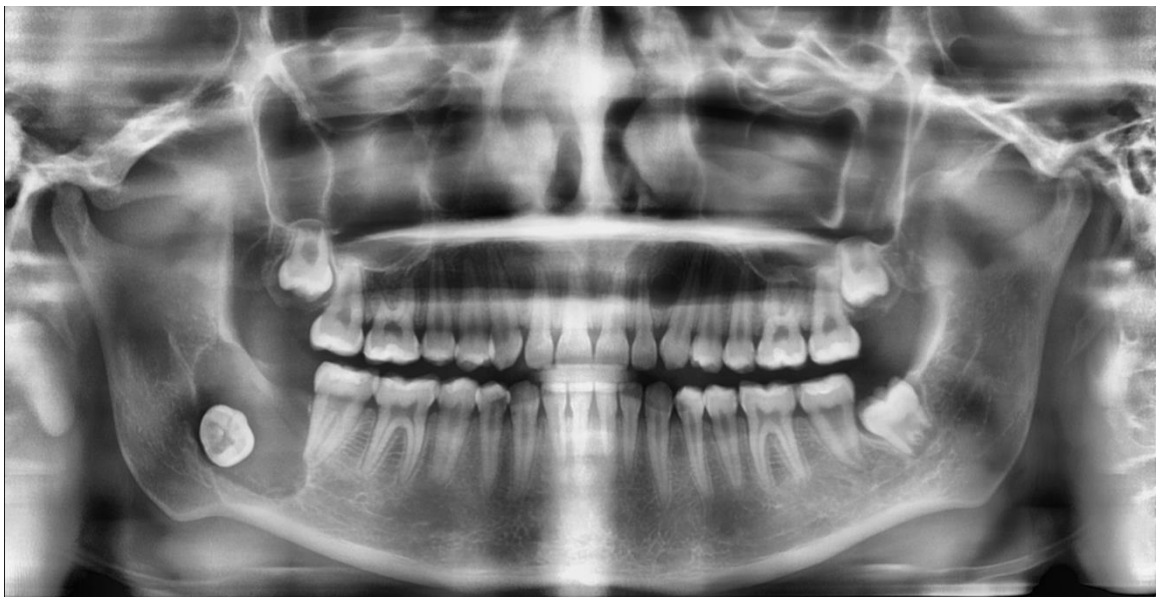


Fig. 3.19. Orthopantomogram of patient S.R., outpatient card No. 175/2. Follicular cyst of the mandible, measuring 3x4 cm, in the region of tooth 48

Treatment: Local anesthesia is administered using Sol. Ultracaini 4% with adrenaline 1:100000, followed by an incision in the transitional fold in the area of teeth 47 and 48. A trapezoidal-shaped mucoperiosteal flap is fully elevated, revealing a defect in the outer cortical plate with a diameter of approximately 5 cm. The defect wall is then expanded using a bur, the cyst membranes are removed, and the defect cavity is thoroughly irrigated with an antiseptic solution. The cavity is then filled with a biocomposite bone graft material called «Bioactive Glass,» combined with platelet-rich plasma (PRP) and lincomycin. Finally, the mucoperiosteal flap is mobilized and secured with interrupted sutures.

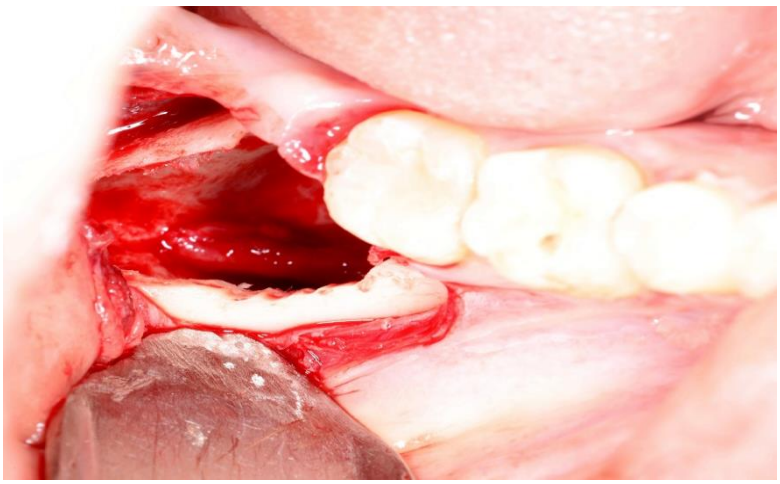


Fig. 3.20. Patient S.R., outpatient card No. 175/2. View of the oral cavity. View of the bone wound after removal of the cyst membrane

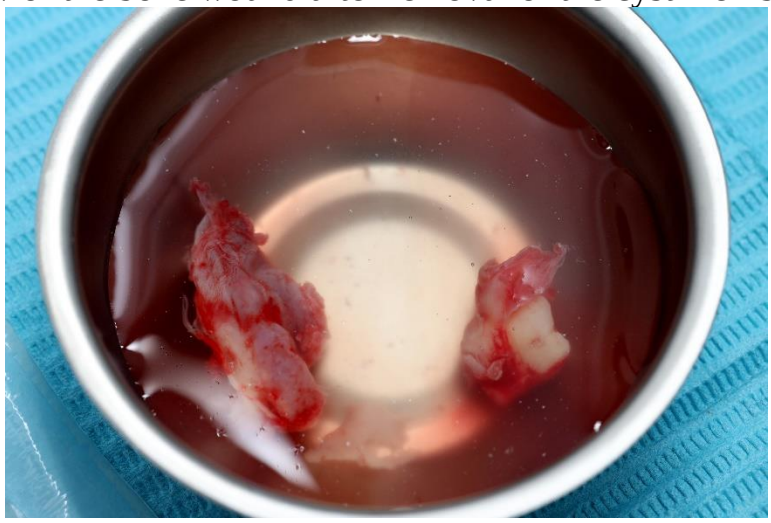


Fig. 3.21. Patient S.R., outpatient card No. 175/2. Removed cyst with membrane and follicle of tooth 48

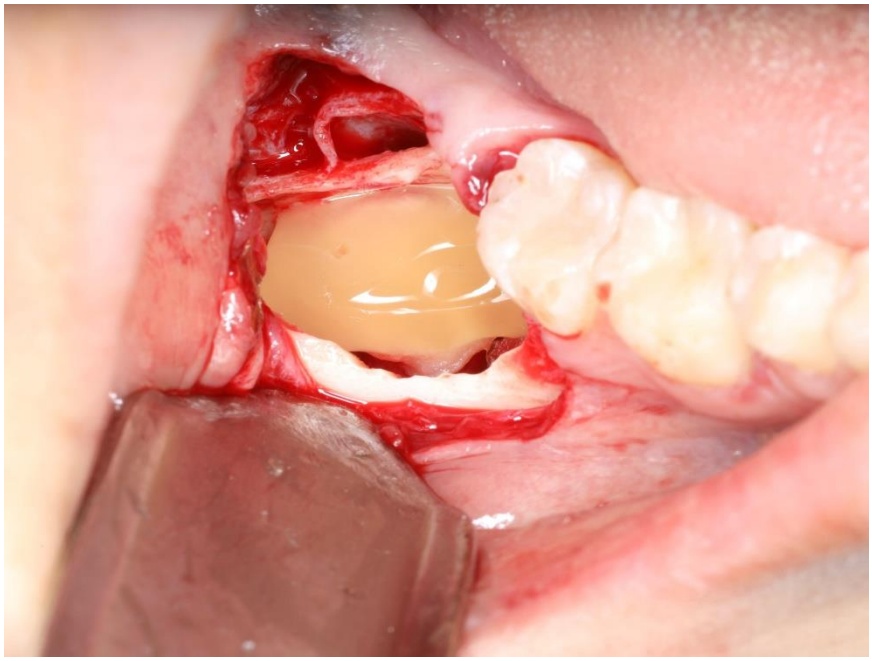


Fig. 3.22. Patient S.R., outpatient chart No. 175/2. After cystectomy with filling of the bone defect using «BS» preparation in combination with PRP and lincomycin.

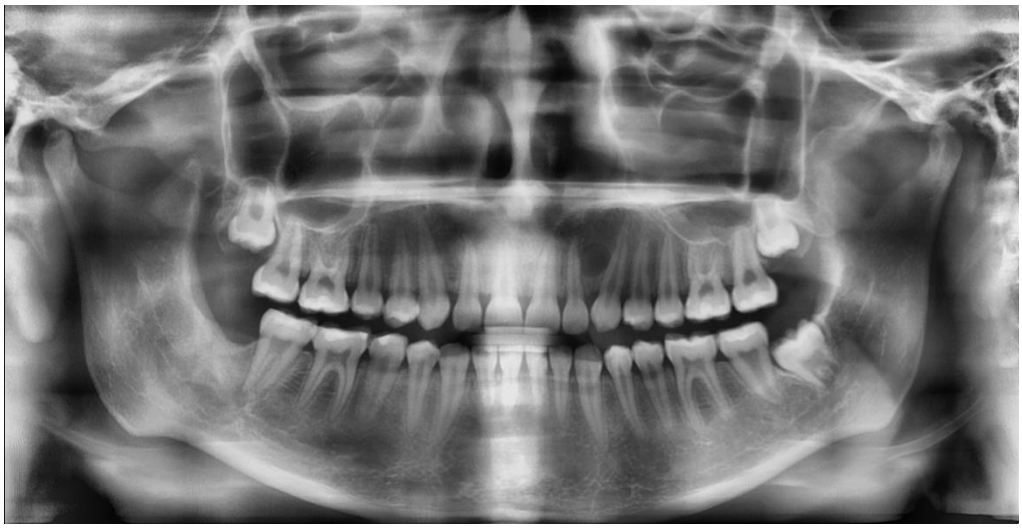


Fig. 3.23. Orthopantomogram of patient S.R., ambulatory card No175/2 3 months after surgery

In the course of post-operative patient monitoring, a significant reduction in pain sensations was noted, particularly in the incision area. All sutures were removed by the end of the 10th day. X-ray images taken at the end of the 3rd month show restoration of tissue elements in the bone defect area; however, the boundaries of this defect remain clearly visible (Fig. 3.23).

The observation results showed that the use of «BS» preparation as an osteoplastic material in combination with PRP and Lincomycin demonstrated high effectiveness in the course of osteointegration processes and activation of protective mechanisms, leading to a noticeable decrease in the risk of complications. These characteristics justify the use of this preparation in combination with an antibiotic for large cysts and extensive surgical interventions.

The basis of this osteoreparative preparation is a compound of calcium hydroxyapatite and tricalcium phosphate, which increases its resorption capacity in later observation periods. Based on this, this preparation is recommended for use with larger cysts.

This group included 36 patients who underwent surgical interventions using «BS in combination with PRP and Lincomycin». The number of complications

when using the «Bioactive Glass» preparation in combination with PRP and Lincomycin was 3 (8.33%).

The data obtained in our research demonstrated the high effectiveness of these preparations based on calcium hydroxyapatite and tricalcium phosphate, which is consistent with scientific literature. In this case, calcium hydroxyapatite and tricalcium phosphate compounds are capable of acting as a matrix for osteoconductive preparations.

### §3.2.3. Evaluation of treatment effectiveness in patients with jaw bone defects using osteoplastic materials based on bone collagen

Currently, osteoplastic preparations based on plastic biological material, particularly bone collagen, are gaining priority. Among the advantages, its low toxicity indicators, higher mechanical strength indicators, and compatibility with dental prostheses can be highlighted.

Sources of biocollagen for surgical dentistry and maxillofacial surgery are animal tissues - skin, sclera, meninges, pericardium, and tendons. The main role is played by proteoglycans and glycosaminoglycans, whose structural unit consists of disaccharide subunits that combine into linear polysaccharides. In the bone tissue of the jaw bones, the extracellular matrix of glycosaminoglycans is represented by chondroitin sulfate. Despite the commonality of GAG groups, their location varies; for example, in periodontal tissues, they are found in almost all tissue structures - vessel walls, periodontal membrane, and gums.

As is known, the synthesis of glycosaminoglycans is essentially a prelude to collagen synthesis. Consequently, with the introduction of an additional volume of synthetic glycosaminoglycan, activation of collagen formation processes occurs, which ultimately enhances the intensity of bone tissue repair processes and the emergence of new vascular pathways, regulating the activity of growth factors. In addition, sGAG also regulates bone mineralization processes by binding calcium salts. Regulation of the synthesis of growth factors, cytokines, and ultimately sGAG becomes one of the factors of the anti-inflammatory mechanism.

All this served as a basis for conducting another part of the experimental work to study the effectiveness of the osteoplastic material «OsteonTM II»based on non-demineralized bone collagen. To address this task, 26 patients were involved, of which 14 were men and 12 were women. The development of postoperative complications compared to the first observation group occurred in only 2 cases, which amounted to just 7.1%. We also determined the high effectiveness of this preparation in the treatment of odontogenic cysts of the jaw bones. Based on the obtained results, we concluded that the use of this osteoplastic material, despite its effectiveness, is limited by the characteristics of the defect itself - its size and extent.

***Clinical Observation Protocol No3.***

Patient V., 37 years old, outpatient record No. 1244. Complaints upon admission: swelling in the area of the anterior teeth on the right side of the upper jaw, noticeable decrease in sensitivity of the gums and part of the upper lip.

X-ray examination: a focus of inflammation and bone tissue destruction in the area of the frontal teeth (11, 12 and 13) of the right upper jaw. The area of destruction has clear boundaries, measuring 2x3 cm.

Diagnosis: Radicular cyst of the upper jaw in the area of teeth 11-13.

Based on the clinical picture of the patient’s condition, a number of additional studies were conducted - the indicators of facial skin electrical excitability and electrical odontometry (EOD) of the pulp of the examined teeth were studied. Results obtained:

1. Nasolabial triangle - the excitability threshold value is 35-45 μA
2. Pulp of teeth 11-13 in the cyst area - EOD indicator 15-18 μA.

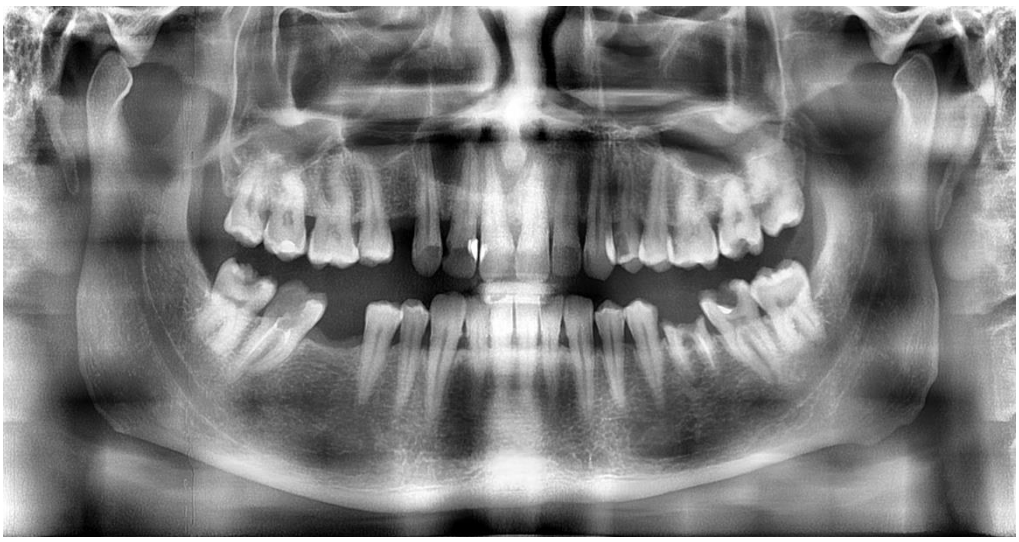


Fig. 3.24. X-ray of patient V., outpatient card No. 1244. Radicular cyst of the upper jaw measuring 2x3 cm in the region of teeth 11-13

An increase in the sensitivity threshold, as well as the electrical excitability of the pulp in the examined teeth, indicates pronounced compressive pressure of the cyst on the incisor nerve.

Treatment: Local anesthesia is administered using Sol. Ultracaini 4% with adrenaline 1:100000, then a trapezoidal-shaped incision is made in the transitional fold in the area of teeth 11-13. The mucoperiosteal flap, also trapezoidal in shape, is fully elevated, revealing a defect in the outer cortical plate with a diameter of about 5 cm. Further, the defect wall is expanded using a bur, the cyst membranes and existing filling material are removed, while the defect cavity is thoroughly washed with antiseptic solution and filled with an average of 2/3 granules of osteoplastic transplant material «OsteonTM II». After this, the mucoperiosteal flap was mobilized, and interrupted sutures were applied.

By the end of the 3rd day of observation in the postoperative period, no complications were detected, the swelling was insignificant, and its symptoms quickly disappeared. No pain sensations or fever were observed, and based on the patient’s condition, the sutures were removed on the 8th day.

Radiologically, 3 months after surgery (Fig. 3.25), signs of bone tissue regeneration are detected; however, complete filling of the defect cavity is not observed. Unfortunately, even a year after surgery, the defect cavity is not filled with

newly formed bone regenerate. Complete restoration of the defect cavity with the formation of new bone tissue is observed by the end of the 18th month.

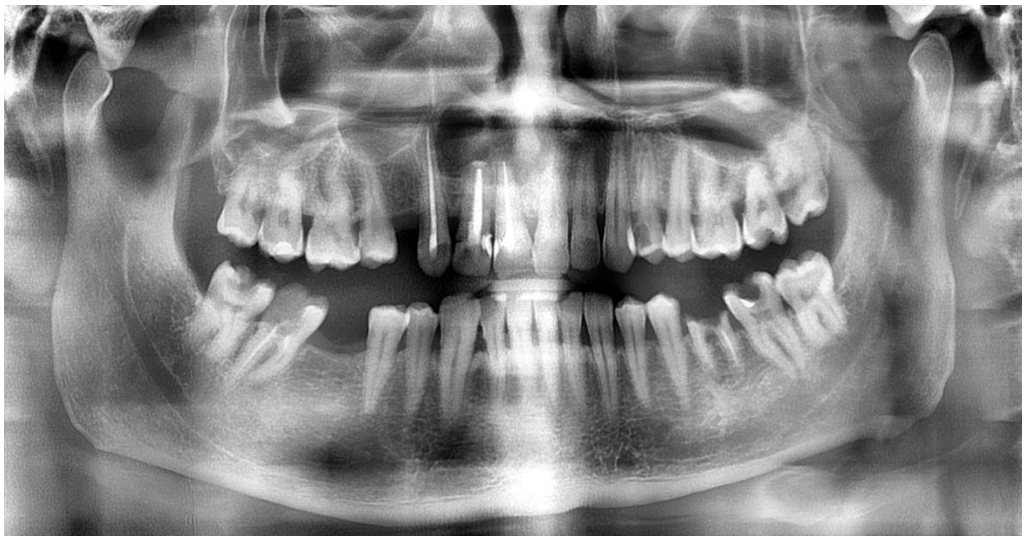


Fig. 3.25. X-ray taken 3 months after surgery and filling of the defect with «OsteonTM II»preparation. Patient V., outpatient card 1244.

By the end of the first year after surgical intervention, the sensitivity threshold decreases, with complete restoration of facial skin sensitivity. The electrical odontometry (EOD) indicators of the central incisors' pulp, as well as the canine, average 3-8 μA.

The obtained data can be interpreted as follows: firstly, the material itself is developed on the basis of bone collagen. The resorption rate observed in patients of this group is not comparable to the indicators of angiogenesis and vasculogenesis processes. In the presence of large defects, the resorption rate does not exceed normal indicators. In such cases, osteoplastic materials based on calcium hydroxyapatite are used, as they have a pronounced effect on repair processes in later stages.

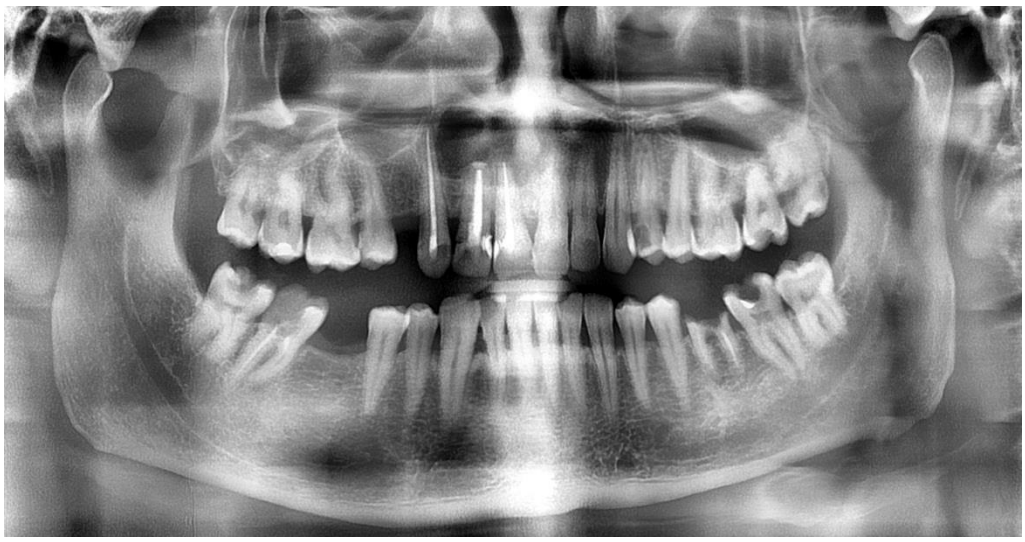


Fig. 3.26. Patient V., outpatient card 1244. X-ray images 12 months after surgery

Based on this statement, the observed lag in the dynamics of reparative osteogenesis in the area of bone tissue defect when using the «OsteonTM II»preparation is explained by the fact that the choice of this preparation was made without taking into account the specific size of the bone base defect of the maxilla, the depth of tissue structure damage. This drug has shown its effectiveness only in small and medium-sized defects.

**Clinical Observation Protocol No4.**

Patient V., 39 years old, outpatient record No982. Complaints upon admission: pain and swelling in the area of the 21st tooth, pain when bitten on the 21st and 22nd teeth. Two months ago, 21 teeth were treated by a dentist-therapist.

Radiograph: bone base defect with clear boundaries, size 1.5* 1.0 cm (3.27-rasm).

Based on the clinical picture, the patient underwent an examination of the pulp EDD of the teeth adjacent to the cystic formation. The study showed that the EDV value of teeth 22-24 was 35-52 μA.

Based on the obtained research results, the patient was recommended to undergo surgical treatment in the form of cystectomy, while preserving 21-22 teeth.

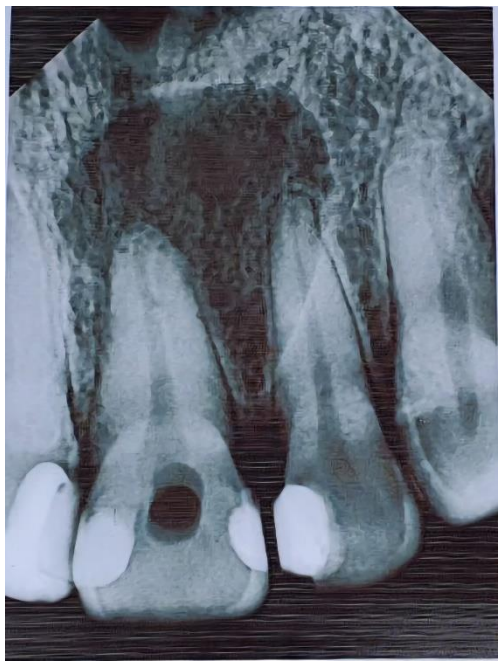


Fig. 3.27. Preoperative radiograph of patient V., outpatient chart 982. Radicular cyst of the maxilla in the region of tooth 21.

Surgical procedure: after local anesthesia, 4% «Ultracaini» solution with adrenaline 1:100000 is administered, followed by a section along the trapezoidal alveolar ridge. The incision is made so that its apex corresponds to the level of the projection of teeth 21-23. The trapezoidal-shaped mucosal-periosteal scrap is also completely removed, under which a defect of the outer cortical plate with a diameter of about 5 cm is detected. Further, the defect wall is expanded using boron, the cyst membranes are removed, the defect cavity itself is completely washed with an antiseptic solution (3% hydrogen peroxide solution) and filled with an average of 2/3 granules of osteoplastic transplant material «OsteonTM II.» After this, the mucosal-periosteal scrap is mobilized, sutured with vicryl. Management of the postoperative period according to the generally accepted scheme. On the 3rd day, the patient showed no symptoms of pain or fever, and there were no signs of inflammation along the incision. The sutures were removed on the 8th day.

Observation of the dynamics of development of restorative processes showed that by the end of the 6th month, bone structure is restored (3.28-rasm).

The newly formed bone tissue in the defect area is represented in the form of bone trabeculae in X-ray images, despite the presence of a clear trabecular pattern

in the center of the defect, signs of bone tissue absence are noted. However, this picture appears to be a defect due to the absence of a penetrating defect on the side of the palatine bone, as bone tissue regeneration is slower due to anatomical features.

By the end of the year after surgery, all signs of complete restoration of the jaw bone defect are observed, and the defect cavity itself is filled with newly formed bone tissue (Figure 3.29).

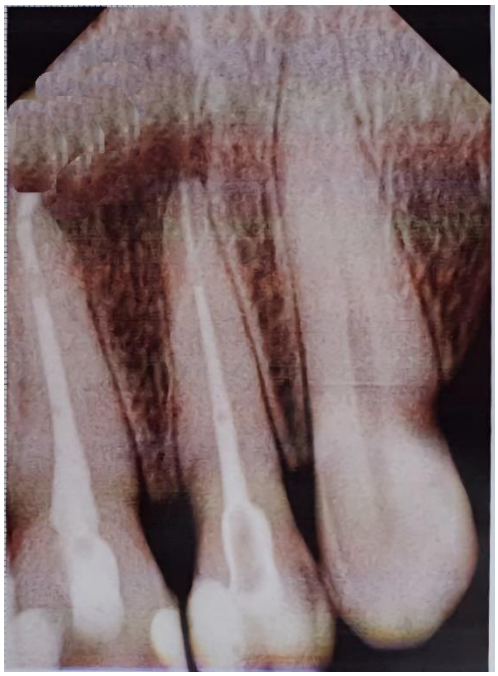


Fig. 3.28. Patient V., ambulatory chart 1244, radiography 6 months after surgery.

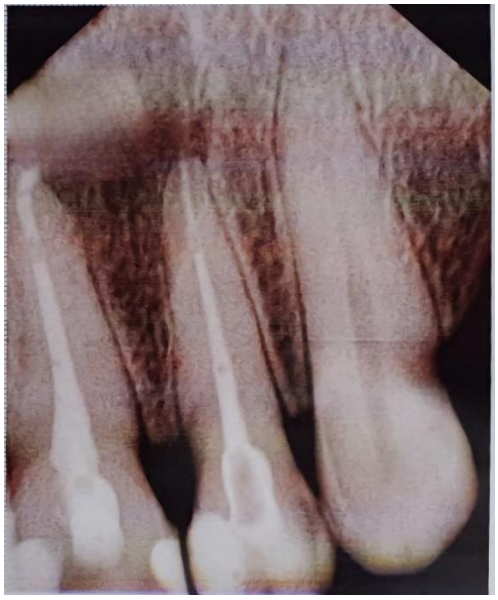


Fig. 3.29. Patient V., ambulatory chart 1244, radiography 12 months after surgery.

Based on the obtained radiological examination data, it can be concluded that the use of osteoplastic transplant material «OsteonTMII» leads to the activation of osteogenesis processes, however, complete regeneration of bone tissue in the area of larger defects, averaging more than 1.0 cm, is not observed.

Consequently, we conclude that the use of this «OsteonTM II»preparation is effective only for jaw bone defects of small size, less than <1 cm. Based on these indicators of the rate of reparative processes, it can be seen that the maximum rate is observed at 2-4 months. This justifies the use of osteoplastic transplant material «OsteonTM II»not only for defect plasty with a volume of up to 1 cm, but also for surgical treatment of periodontitis.

Analysis of the use of various osteoplastic preparations showed that, regardless of the type of preparation, the total number of complications in the main group and the control group differ insignificantly by the 3rd day of observation. Swelling in the soft tissues, for example, occurred equally in patients of both groups, in particular, 36.32±0.48% in the control group versus 35.6±0.34% of patients in the comparison group, respectively. Tissue hyperemia in the observation group was detected in almost 40.0% of patients, in contrast to 36.0% of cases in the control group, respectively.

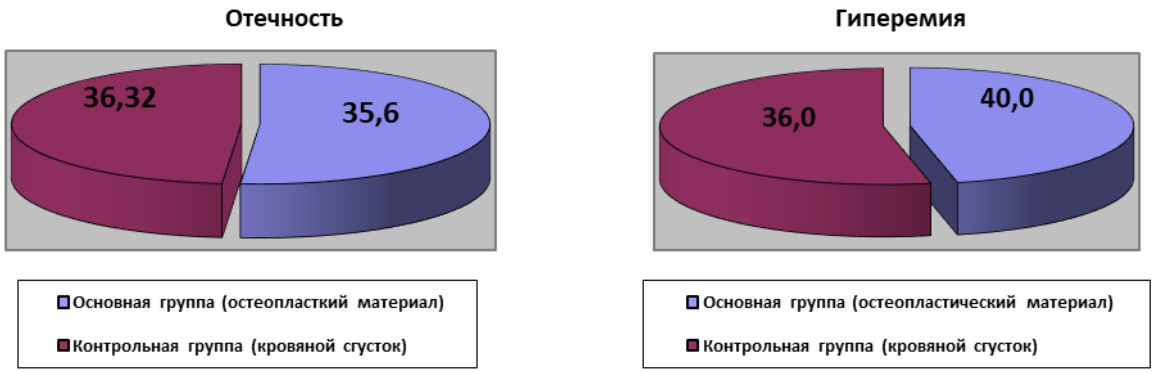



Fig. 3.30. Number and type of local postoperative complications

Signs of inflammatory processes in the area of the operated defect were noted in 29.1±0.2% of patients in the control group, while in patients of the main group after osteoplasty with calcium hydroxyapatite-based transplant material in

more than half of the patients, respectively. This can be explained by the fact that when using an osteotransplant in the bone defect zone, the activity of macrophages increases, which indicates the beginning of resorption processes.

Pain symptoms were detected in 36.8% of patients in the control group and 24.8% of patients in the main group, respectively. However, these painful sensations ceased at the end of the week after the operation.

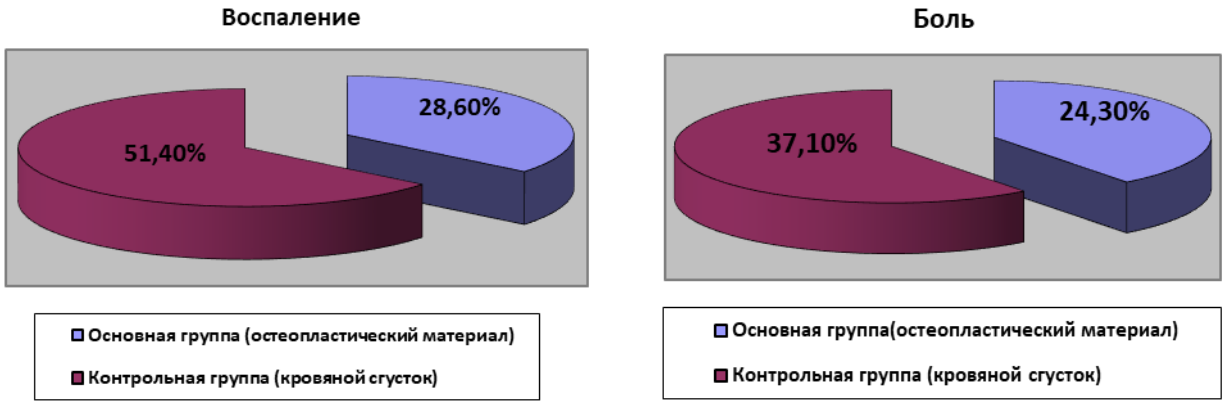



Fig. 3.31. Number and type of local postoperative complications

In the case of surgical treatment of patients with jaw defects without the use of plastic material, it was revealed that after 1 month of surgery, a slight darkening appears in the diameter of the cavity at the site of the defect in the radiological images. Further, within 3 months of observation, the defect decreases by an average of 35-40% in only 54.8% of patients, while in other cases, no changes in tissue structures are observed. After six months, the percentage of patients with osteogenesis signs increases, reaching 68%, in such patients, the intensity of the radiological picture of the bone neoplasm is not pronounced in the center, while the regeneration pattern is noticeably improved on the periphery. In the remaining part of the patients, the contours of the newly formed tissue have the appearance of a trabecular structure, gradually merging with the surrounding healthy tissue. Within 12 months, 15% of patients in this group show signs of complete replacement of the tissue structures of the defect, while in 85.0% of patients, the defect replacement process occurs only in 75-85% of cases.

The best values of the effectiveness of the «OsteonTM II»osteotransplant

were noted when filling small defects, i.e., within one tooth, and most importantly, by the 6th month of observation, the operated area of bone tissue is fully restored (Table 3.1).

*Table 3.1*

**Comparative assessment of the optical density of bone tissue according to the Haunsfield scale (PD) during plastic surgery of small and medium-sized bone defects at different observation periods**

| Groups | Observation periods (months) | | | |
|---|---|---|---|---|
| | 3 | 6 | 9 | 12 |
| Control group (blood clot) n=10 | 130±10 | 320±10 | 420±10 | 580±10 |
| Main group («OsteonTM II») n=10 | 300±10* | 620±10* | 725±5* | 830±10* |

* - p<0,05 compared to the control group

*Table 3.2*

**Comparative assessment of the optical density of bone tissue according to the Haunsfield scale (PD) during plastic surgery of large bone defects at different observation periods**

| Groups | Observation periods (months) | | | |
|---|---|---|---|---|
| | 3 | 6 | 9 | 12 |
| Control group (blood clot), n=11 | 100±10 | 260±10 | 290±10 | 520±10 |
| Main group («OsteonTM II»), n=9 | 170±10* | 290±10* | 395±5* | 625±5* |

* - p<0,05 compared to the control group

In cases of large defects within three or more teeth, the use of this drug led to an increase in bone tissue regeneration processes, however, the observation dynamics showed that complete recovery is not observed even by the end of the 1st year after surgery (Table. 3.2). Thus, the use of «OsteonTM II»transplant material is recommended for filling small and medium-sized defects where its osteoplastic properties are most pronounced.

*Table 3.3*

**Comparative assessment of the optical density of bone tissue according to the Haunsfield scale (PD) during plastic surgery of small and medium-sized bone defects at different observation periods**

| Groups | Observation periods (months) | | | |
|---|---|---|---|---|
| | 3 | 6 | 9 | 12 |
| Control group (blood clot) n=10 | 130±10 | 320±10 | 420±10 | 580±10 |
| Main group («Bioactive glass» in OTP complex with linkomycin») n=10 | 310±10* | 650±10* | 730±10* | 845±5* |

* - p<0,05 compared to the control group

During this study, we conducted a study of the effectiveness of the «Bioactive Glass» osteoplastic material in combination with OTP and linkomycin. This preparation is used in the form of granules, which allows filling the defect in full volume. The conducted radiological studies showed that this granulated preparation can be used for defects of varying sizes, and during the observation period, signs of enhanced reparation and regeneration processes are noted (Table. 3.3).

In the presence of small and medium-sized defects, the use of the «Bioactive Glass» preparation in combination with OTP and linkomycin leads to complete restoration of bone tissue in the operated area by the end of the 6th month, only in some places are small gap-like layers filled with newly formed bone fragments diagnosed. In the presence of larger-volume defects, trabecular bone tissue filling of the defect is observed radiologically during these periods, although not completely (Table. 3.4).

*Table 3.4*

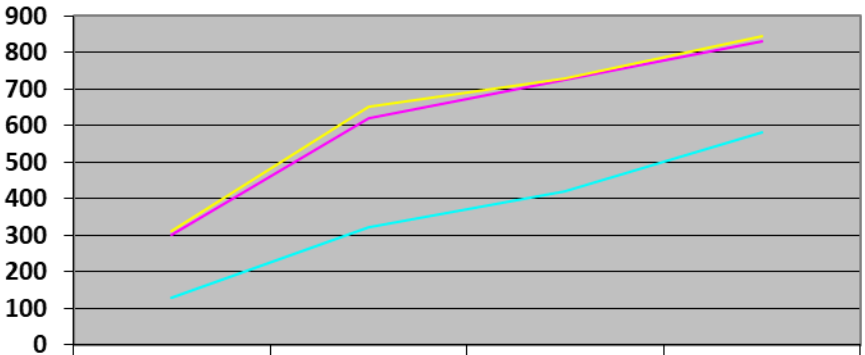
**Comparative assessment of the optical density of bone tissue according to the Haunsfield scale (PD) during plastic surgery of large bone defects at different observation periods**

| Groups | Observation periods (months) | | | |
|---|---|---|---|---|
| | 3 | 6 | 9 | 12 |

| | | | | |
|---|---|---|---|---|
| Control group (blood clot) n=11 | 100±10 | 260±10 | 290±10 | 520±10 |
| Main group («Bioactive glass» in OTP complex with linkomycin») n=9 | 245±5* | 515±5* | 750±10* | 850±10* |

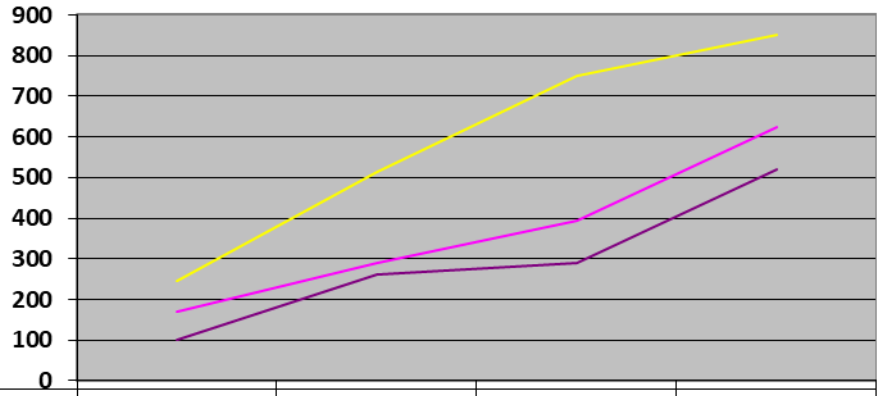
* - p<0,05 compared to the control group

Thus, when comparing the effectiveness of the osteoplastic materials used, we determined that for filling small and medium defects of the jaw bones, the most effective is the osteoplastic preparation «OsteonTM II», while for larger defects of the jaw bones, the most effective is the material «Bioactive Glass» in combination with OTP and linkomycin.




| | 3 | 6 | 9 | 12 |
|---|---|---|---|---|
| OsteonTM II | 300 | 620 | 725 | 830 |
| «БС» в комплексе ОТП с линкомицином | 310 | 650 | 730 | 845 |
| Контрольная группа (кровяной сгусток) | 130 | 320 | 420 | 580 |

Fig. 3.32. Bone tissue optical density (on the Hounsfield scale) during reconstruction of small and medium bone defects in the main group (osteoplastic material) and control group (blood clot) at different observation periods




| | | | | |
|---|---|---|---|---|
| OsteonTM II | 170 | 290 | 395 | 625 |
| БС» в комплексе ОТП с линкомицином | 245 | 515 | 750 | 850 |
| Контрольная группа (кровяной сгусток) | 100 | 260 | 290 | 520 |

Fig. 3.33. Optical density of bone tissue (according to the Haunsfield scale) during plastic surgery of large bone defects in the main (osteoplastic material) and control groups (blood clot) at different observation times

As can be seen from the data obtained as a result of our research, the use of osteoplastic materials based on calcium hydroxyapatite and xenocollagen enhances osteogenesis and regenerative processes compared to the data of the control group, where bone tissue restoration processes occurred simply under a blood clot. Also, as the bone defect is filled with the above-mentioned preparations, the optical density of the bone tissue increases. When comparing the effectiveness of the osteoplastic materials used, we found that for filling small and medium-sized defects of the jaw bones, the osteoplastic preparation «OsteonTMII» is most effective, while for larger defects of the jaw bones, the material «Bioactive glass» in combination with OTP and linkomycin is most effective.

## §3.3. Results of gnathodynamometric studies

After the performed dental operations, a decrease in the stability indicators of the tissue structures of the periodontal complex of the supporting teeth is observed. Maintaining periodontal stability during prosthetics in operated patients is an important aspect in the work of a dentist-orthopedist. And the use of osteoplastic materials as an activator of reparative bone regeneration leads to an increase

in the severity of these processes and, ultimately, to the preservation of the periodontal complex.

*Table 3.5*

**Gnatodynamometry indicators (kg) before and after surgery, M±m (confidence interval)**

| Group | Intact tooth | Поврежденный зуб | | | | |
|---|---|---|---|---|---|---|
| | | before surgery | after 3 months | after 6 months | after 9 months | after 12 months |
| Main | 13,3±0,39 | 7,02±0,18 | 9,15±0,17[a] | 11,9±0,32[a] | 13,7±0,35[a] | 13,3±0,37 |
| Controlling | 14,2±0,52 | 7,0±0,23 | 7,1±0,19^ | 9,08±0,22[a] | 10,3±0,27[аб] | 10,0±0,27[a] |
| Comparative | 13,2±0,49 | 7,01±0,28 | 9,13±0,27[a] | 11,5±0,52[a] | 13,5±0,45[a] | 13,2±0,4 7 |

Note: a - p<0,05 compared to the data before treatment; b - p<0.05 compared to the control.

Gnatodynamometry is recommended for objective assessment of dental function. These studies were conducted on 144 teeth, both before and after surgery, with some patients using osteoplastic materials, as well as without them (Table 3.5).

According to the observation data, the obtained results in all observation groups corresponded to values of 7.0±0.23, 7.01±0.28, and 7.02±0.18, respectively. After some time (3 months), the values differed from 7.1±0.19 to 19.16±0.15 (p<0.05) in all groups.

After osteoplastic surgeries, the indicators of periodontal stability of the studied teeth improve compared to the control group, approaching the values of healthy teeth.

Thus, based on the obtained data, it can be stated that the stability of the periodontium depends primarily on the intensity of bone tissue reparative regeneration

processes. In this case, in the case of using osteoplastic material for tooth root resection or bone tissue defects, the periodontal stability indicators almost correspond to the values of healthy teeth.

### §3.4.Results of microbiological studies in patients after cystectomy

As is known, the components of the mucous membrane have protective mechanisms that contribute to the preservation of normal microflora in the oral cavity, and the disruption of resistance leads to a disbalance in the state of the microbial relief, thereby contributing to the formation of an infection focus. All results are presented as a unit of measurement - the decimal logarithm of the number of colony-forming units per 1 g (lg KOE/g).

Results of microbiological studies of the oral cavity in patients with jaw cysts before treatment showed the presence of microbiocenosis disorders in 100% of observations.

*Table 3.6*

**Microflora of the oral cavity of patients in the first group before and after surgery (% inoculation)**

| Microorganism | without a/б (n=16) | | with a/б (n=16) | |
|---|---|---|---|---|
| | before surgery | after surgery | before surgery | after surgery |
| Staph. saprophyticus | 19,1±6,13 | 52,4±7,8** | 25,0±6,68 | 55,0±7,68** |
| Staph. epidermidis | 28,6±7,06 | 28,6±7,06 | 30,0±2,24 | 43,5±7,65 |
| Staph. aureus | 100,0 | 33,3±7,36*** | 100,0 | 26,1±6,78*** |
| E. coli | 81,0±6,13 | 38,1±7,58*** | 80,0±1,95 | 30,4±7,09*** |
| Candida sp. | 90,5±4,58 | 28,6±7,06*** | 90,0±4,63 | 47,8±7,71*** |

Note:* - differences relative to the data before treatment are significant (** - p<0,01, *** - p<0,001)

*Table 3.7*

**Oral microflora of patients in the second group in the postoperative period (% inoculation)**

| Microorganism | without a/б (n=16) | | with a/б (n=16) | |
|---|---|---|---|---|
| | before surgery | after surgery | before surgery | after surgery |
| Staph. saprophyticus | 20,0±6,96 | 33,3±8,21 | 23,5±7,38 | 37,1±8,32 |
| Staph. epidermidis | 66,7±8,21 | 60,0±8,53 | 64,7±8,32 | 52,9±8,69 |
| Staph. aureus | 86,7±5,92 | 60,0±8,53* | 82,4±6,64 | 41,2±8,57*** |
| E. coli | 86,7±5,92 | 53,3±8,68** | 88,2±5,61 | 41,2±8,57*** |
| Candida sp. | 66,7±8,21 | 60,0±8,53*** | 64,7±8,32 | 52,9±8,69 |

Note:* - differences relative to the data before treatment are significant (** - p<0,01, *** - p<0,001)

As the duration of surgical intervention increases, the number of microbiocenosis disturbances also increases. In the control group, where the defect heals under a blood clot, dysbacteriosis occurs in 30-35% of cases. In contrast, when using the osteoplastic preparation «OsteonTM II,» it occurs in 18.0% of cases, and with the preparation «Bioactive Glass» in combination with PRP and lincomycin - in 5.0% of cases, respectively (Table 3.8).

*Table 3.8*

**Microflora of the oral cavity of patients in the third group before and after surgery (% inoculation)**

| Microorganism | BS with TPP + a/b (n = 32) | | P |
|---|---|---|---|
| | before | after | |
| Staph. saprophyticus | 21,74±4,89 | 69,57±5,46 | <0,001 |
| Staph. epidermidis | 60,87±5,79 | 34,78±5,65 | <0,01 |
| Staph. aureus | 91,30±3,34 | 13,04±3,99 | <0,001 |
| E. coli | 52,17±5,93 | 8,70±3,34 | <0,001 |
| Candida sp. | 82,61±4,49 | 17,40±4,49 | <0,001 |

According to the data in Table 3.8, the microflora indicators in all observation groups are homogeneous ($p > 0.05$).

*Table 3.9*

**Frequency of detection of various microorganisms colonization of the patient's oral cavity before treatment**

| Microorganism | Seeding frequency index for the group | | | | | |
|---|---|---|---|---|---|---|
| | III (БС с ОТП + а/б) (n = 32) | | II (О) (n = 32) | | I (Кр.с) (n = 32) | |
| | абс. | M ± m, % | абс. | M ± m, % | абс. | M ± m, % |
| Staph. saprophyticus | 9 | 26,5 ± 7,6 | 7 | 25,0 ± 8,3 | 6 | 18,2 ± 6,7 |
| Staph. epidermidis | 4 | 11,8 ± 5,5 | 3 | 10,7 ± 5,9 | 2 | 6,1 ± 4,2 |
| Staph. aureus | 3 | 8,8 ± 4,9 | 4 | 14,3 ± 6,7 | 5 | 15,2 ± 6,2 |
| E. coli | 3 | 18,8 ± 4,9 | 4 | 14,3 ± 6,7 | 6 | 18,2 ± 6,7 |
| Candida sp. | 9 | 26,5 ± 7,6 | 5 | 17,9 ± 7,4 | 8 | 24,2 ± 7,5 |

*Table 3.10*

**Frequency of detection of various microorganisms in the oral cavity of patients after treatment**

| Microorganism | Seeding frequency index for the group | | | | | |
|---|---|---|---|---|---|---|
| | III (БС с ОТП + а/б) (n = 32) | | II (О) (n = 32) | | I (Кр.с) (n = 32) | |
| | абс. | M ± m, % | абс. | M ± m, % | абс. | M ± m, % |
| Staph. saprophyticus | 1 | 2,9 ± 2,9* | 4 | 14,3 ± 6,7 | 3 | 9,1 ± 5,0 |
| Staph. epidermidis | 1 | 2,9 ± 2,9* | – | – | 1 | 3,0 ± 3,0 |
| Staph. aureus | – | – | 1 | 3,6 ± 3,6 | 2 | 6,1 ± 4,2 |
| E. coli | 1 | 2,9 ± 2,9* | 1 | 3,6 ± 3,6 | 2 | 6,1 ± 4,2 |
| Candida sp. | 2 | 5,9 ± 4,0* | 3 | 10,7 ± 5,9 | 3 | 9,1 ± 5,0* |

*$p \leq 0.05$- the values have a significant difference from the values before the cystctomy operation, presented in Table 3.9.

Comparative analysis showed that:

1. When using osteoplastic material «Bioactive glass» in combination with OTP and antibiotic, the microflora is represented by many microorganisms, however, there are no Klebsiella, Staph.aureus;

2. The use of osteoplastic material «OsteonTM II»in patients leads to a decrease in the quantitative indicators of oral microbiogenesis, especially in the complete absence of Provotellaoralis and Staph. Epidermidis;

3. When restoration is carried out under a blood clot, the germination of microorganisms tends to decrease, however, no clear trend is observed (p>0.05), however, the growth of Provotellaoralis in microorganism colonies is not observed.

It should be borne in mind that before surgery, the indicators of contamination intensity in all studied groups did not have clear differences.

*Table 3.11*

**Intensity of oral cavity contamination before treatment (lgKOE/g)**

| Microorganism | M ± m intensity of contamination for the group | | |
|---|---|---|---|
| | III (БС с ОТП + а/б) (n = 32) | II (О) (n = 32) | I (Кр.с) (n = 32) |
| Staph. Saprophyticus | 5,0 ± 0,8 | 5,1 ± 0,5 | 4,9 ± 0,2 |
| Staph. epidermidis | 2,5 ± 0,2 | 2,2 ± 0,1 | 2,4 ± 0,2 |
| Staph. aureus | 5,1 ± 0,3 | 4,6 ± 0,6 | 4,8 ± 0,4 |
| E. coli | 8,5 ± 0,7 | 7,8 ± 1,3 | 8,3 ± 1,1 |
| Candida sp. | 25,1 ± 4,0 | 22,7 ± 2,8 | 23,0 ± 4,0 |

*Table 3.12*

**Intensity of oral cavity contamination after treatment (lgKOE/g)**

| Microorganism | Seedling frequency indicator for the group | | |
|---|---|---|---|
| | III (БС с ОТП + а/б) (n = 32) | II (О) (n = 32) | I (Кр.с) (n = 32) |
| Staph. saprophyticus | 1,7 ± 0,2* | 3,1 ± 0,5* | 2,0 ± 0,3* |
| Staph. epidermidis | 0,9 ± 0,1* | 1,6 ± 0,3* | 0,8 ± 0,2* |
| Staph. aureus | 1,8 ± 0,1* | 2,2 ± 0,2* | 1,7 ± 0,1* |
| E. coli | 2,8 ± 0,5* | 3,9 ± 0,4* | 3,2 ± 0,5* |
| Candida sp. | 13,2 ± 1,9* | 16,8 ± 2,7* | 14,8 ± 3,1* |

* ($p \leq 0.05$) have a significant difference from the values before the cystctomy operation, presented in Table 3.11.

After surgical intervention, changes in these indicators of oral cavity contamination are observed. However, the values of golden staphylococcus most demonstrably decreased with the use of BC with OTP + a/b by 3.5 times, whereas with OsteonTM II they decreased by 2.7 times and in the control group by only 2.0 times. E.coli contamination before and after surgery was within the values of TS with OTP + a/b by 3.0 times, while in OsteonTM II it decreased by 2.0 times and

in the control group by only 2.5 times.

Thus, the results of microbiological studies showed that in the first group, after using «Bioactive Glass» in the OTP complex with antibiotics, no signs of swelling or fever were observed, even with larger defects.

We also found that the use of osteoplastic materials leads to the development of a uniform tissue reaction, resulting in the formation of a defect in the cavity of fine-fiber connective tissue with the formation of a capsule, local lymphomacrophage infiltrates. All this indicates the development of osteoreparative activity in the operated area of the maxilla. At the same time, within 30 to 60 days, growth of newly formed bone tissue is observed in the defects. It should also be noted that the osteointegration processes against the background of the osteoplastic materials used manifest themselves precisely at this time, however, the rate of development of these processes varies. All this leads to changes in the structure of the newly formed bone tissue.

In accordance with the stated goal of this study, we were tasked with assessing the clinical effectiveness of the used bone-forming preparations based on calcium hydroxyapatite and xenocollagen («Bioactive Glass» in a complex of OTP with antibiotics and «OsteonTM II») in the plastic surgery of jaw bone defects. This study involved 96 patients who were divided into 3 groups:

1st group (n=36) - for bone tissue defects, the preparation «Bioactive Glass» was used in combination with the antibiotic linkomycin;

2nd group (n=28) - «OsteonTM II»was used to fill the defect cavity;

3rd group (n=32) - the cavity of the bone defect is filled with blood clots during surgery.

The obtained results showed that when using the osteoplastic material «Bioactive Glass» in combination with the antibiotic linkomycin, complications were noted in 3 cases. The greatest clinical effect when using this drug is observed in medium and large defects. This is explained by the duration of reparative processes in the bone tissue, as well as the presence of a high degree of resorption, and it is precisely these features that make this compound effective for large defects of the

bone base of the jaw.

Interpreting the obtained data, this drug can be classified as an osteoconductive material, i.e., it can serve as a basis or passive matrix for the further formation of new bone tissue, ultimately increasing the effectiveness of surgical treatment precisely for large (3 or more teeth) bone tissue defects.

In the group of patients who used «OsteonTM II»as osteoplastic material, this drug significantly activates regeneration processes after cystectomy, thereby demonstrating its effectiveness. The number of complications is also significantly reduced, only 2 cases. However, when studying the relationship between the drug's effect and the parameters of the cystic cavity, it was found that maximum effectiveness is achieved with sizes within 1-3 teeth, and with larger defects, the bioresorbable property of «OsteonTM II»is ineffective. Since the maximum rate of development of resorption processes manifests itself within 2-4 months of the postoperative period, this allows the use of this drug not only in the surgical treatment of small and medium-sized jaw defects but also in the treatment of periodontitis.

In the control group, 23.2% of patients underwent cystectomy followed by resection of the apical part of the tooth root, of which 5.6% were in the lower jaw and 17.6% in the upper jaw, followed by closure of the defect cavity with a blood clot. Data from observations of regeneration processes showed that 90.7% of patients showed their effectiveness, however, complete recovery could only be seen after 1.5-2 years for minor defects and up to 3 years for extensive bone defects. In this group, the development of postoperative complications in the form of fistulas, purulent processes, and recurrence of odontogenic cysts is high. One patient had to undergo repeated surgical intervention due to the formation of a fistula at the site of the surgical incision.

According to the optical density indicators of the Haunsfield scale, the osteoplastic materials we used activate the processes of reparative regeneration in bone defects, and this effectiveness is much higher than with simple closure under a blood clot. At the same time, the optical density of bone tissue significantly exceeds the values of the control group.

The conducted gnathodynamometric measurements showed that the tooth periodontal tissue endurance index directly depends on the degree of reparative regeneration of bone tissue in the operated area. Observation results showed that by the end of the year, the endurance values of the periodontal complex components approached the desired indicators of intact teeth.

Interpreting the microbiological research data, we concluded that the intensity of infection with transient opportunistic microflora significantly decreases when using «Bioactive glass» in combination with OTP with linkomycin (Table 3.12). When closing the «OsteonTM II»defect, there is also a tendency towards a decrease in the intensity of contamination, however, these changes are unreliable. In the control group, where the defect was covered with a blood clot, the decrease in indicators was reliable, but only for some strains of pathogenic microorganisms.

## CONCLUSION

With the introduction of modern innovative methods, cutting-edge technologies, and composite materials into the clinical practice of surgical dentistry, many approaches to performing bone grafting for defects of various sizes in the maxillofacial region have changed. Nevertheless, the focus remains on creating osteoplastic material that promotes the activation of reparative osteogenesis.

Based on the above, an important task is the development and implementation of new innovative, highly effective methods for osteoplasty of congenital and acquired jaw bone defects in clinical practice. This will ensure the anatomical integrity of the dentoalveolar system in the shortest possible time and expand the range of indications for dental implant placement in various conditions of the alveolar process bone base, even with bone tissue deficiencies.

Recently, bioactive glass (a group of surface-active biomaterials) has been widely used. When used, it triggers a number of specific reactions resulting in the formation of crystalline hydroxyapatite or so-called amorphous calcium phosphate. This, in turn, promotes the activation of bone tissue regeneration and proliferation processes. Additionally, the release and increase of Si, P, Ca, and Na ions induce osteogenesis processes.

Types of bioactive glass are used in various forms for medical applications, such as granules and plates for orthopedic and maxillofacial bone cavity filling and bone reconstruction.

The main advantage of using bioactive glass as a bone graft substitute is that it eliminates the need to harvest bone grafts from a secondary site. Within the various compositions of bioglass, it is possible to activate bone growth processes while negatively affecting bacterial growth and reproduction.

Thus, innovative osteoplastic materials based on bone collagen, sulfated glycosaminoglycans, tricalcium phosphate salts, and hydroxyapatite in the form of granules, powder, ceramics, and colloidal forms have gained wide recognition. These include the widely used «OsteonTM II»and «BS.» However, despite several

advantages of this group of materials, frequent use without proper indications in various dental diseases (periodontitis, cystic formations of jaw bones, chronic osteomyelitis, etc.) has led to a decrease in its clinical effectiveness and the occurrence of various cases of rejection of the used bone graft material.

Based on this, we were tasked with conducting a comparative characterization of the various plastic materials used in clinical practice in terms of structure and composition, as well as identifying the peculiarities of regenerative processes when using them in the treatment of jaw bone defects.

Consequently, we conducted an experimental study on Chinchilla rabbits, for which an experimental model of various bone defects was developed. These defects were subsequently filled with various osteoplastic materials of the following types:

1) ««OsteonTM II»- a two-phase calcium phosphate composed of 30% hydroxyapatite + 70% β-tricalcium phosphate in combination with natural (bovine) type I collagen;

2) Bioactive glass with a mass fraction of %- MgO 8,75 - 8,96; $CaF_2$ 5,65 - 5,79; $P_2S_5$ 6,22-7,19; $Si0_2$ 40,08 - 46,06; $Na_20$ 4,49-4,59; $B_20_3$ 0-5,16; CaO 28,66-30,44.

The criteria for evaluating the effectiveness of osteoplastic material were indicators of the dynamics of regenerative processes in the areas of jaw bone defects (rate, volume of regeneration area). Histological sections of jaw defect repair under blood clot were used as a control.

The model for creating an artificial defect involved creating uniform bone tissue defects in the angle area of rabbits' lower jaws. In the control group, bone callus formation was observed by day 90, with its volume not exceeding 1/3 of the total defect volume. If bone callus formation indicators showed acceleration of bone repair processes during the 30-90 day observation period, the results could be considered positive.

The clinical effectiveness of the osteoplastic materials used in our study was

determined based on indicators of the intensity and rate of regenerative processes and new bone tissue formation in the defect areas.

We analyzed histological preparations of forming bone neoplasm samples obtained from experimental studies at various observation periods.

In the control group, soft tissue conglomerate formation occurred in the initial stages. By around day 60, it transformed into a cellular-fibrous structure, and in later periods (90 days), it was completely replaced by coarse fibrous connective tissue. This is the main reason for the deterioration in regenerative process intensity, ultimately resulting in incomplete healing of bone defects even by the end of the observation period.

When using osteoplastic materials, the highly cellular structural organization of the formed conglomerate is striking. In the field of view, besides fibroblasts, lymphocytes and macrophages are observed, as well as giant multinucleated cells of the used osteoplastic material. It should be noted that polymorphic cellular proliferation persists throughout all observation periods. We also concluded that the identified giant multinucleated cellular structures provide direct evidence of reparative regeneration development.

In the forming conglomerate, a layer of fibroblasts forms around hydroxyapatite fragments, which later transforms into a capsular layer consisting of fibrils. In addition to increasing the volume of the newly formed bone tissue conglomerate, osteointegration processes with the transplant are activated, with trabeculae forming complexes with the material substance. As time progresses, hydroxyapatite particles become embedded in the newly formed bone tissue, which has a density indistinguishable from that of the main bone.

Similar changes are observed when using the «Bioactive Glass» material in combination with PRP + antibiotic (lincomycin). It should be noted that the intensity of bone tissue formation in the defect cavity being filled is noticeably higher than when using the «OsteonTM II»preparation.

When using the osteoplastic substance «Bioactive Glass» in combination with PRP + antibiotic (lincomycin), the intensity of replacement bone formation

increases, filling more than 2/3 of the cyst cavity volume. With «OsteonTM II,» the process of filling the cyst cavity with forming bone callus is less than 2/3 by 90 days of observation.

Based on this, a factor stimulating bone formation is the mechanism of secondary osteogenesis development due to the mutual reaction of biologically active substances and hydroxyapatite particles. Additionally, the osteoplastic materials we used in the experiment contribute to the activation of osteogenesis processes, with new bone structures being histologically identified. Composition of «BS» preparation: CaO28,66-30,44; $Si0_2$ 40,08-46,06; $P_20$ 56,22-7,19; MgO 8,75-8,96; $CaF_2$ 5,65-5,79; $Na_20$ 4,49-4,59; $B_20$ 30-5,16. The drug itself comes in combination with platelet-enriched plasma. In the dynamics of observation in the area of the bone defect, the formation of a bone callus with numerous trabecular systems occurs.

The «OsteonTM II»preparation contains two-phase CaPO4, as well as 30% calcium hydroxyapatite, 70% β-tricalcium phosphate, and natural (bovine) type I collagen. This material is characterized by a slower course of reparative resorption processes, thereby slowing down the processes of secondary restructuring of the newly formed bone substance.

Based on the above, a more effective component of bioplastic materials is calcium hydroxyapatite granules, and in the «OsteonTM II»structure, these particles have a larger form. The most effective are smaller shapes and sizes to produce a higher potential for action. The use of modern osteoplastic materials in various surgical operations aims to reduce the risk of complications due to the breakdown of blood clots and their secondary infection. To clinically study the effectiveness, we used osteoplastic composite materials from various manufacturers: «OsteonTM II»(«Genoss» company, South Korea), «BS» (used in the scientific study «Bioactive glass» was developed by a group of scientists led by Professor Dilshat Ubaydullayevich Tulyaganov of the Turin Polytechnic University in Tashkent, and was granted patent No. IAP 03947, Uzbekistan), containing hydroxyapatite, tricalcium phosphate, demineralized and non-demineralized bone collagen, HAP, which

we studied earlier in the experiment.

This study was conducted at the clinical base of the Department of «Maxillofacial Diseases and Traumatology» of the Tashkent State Dental Institute, as well as at the surgical dentistry polyclinic of the Tashkent State Dental Institute clinic.

Based on the osteoplastic material used to fill the bone defect in the jawbone, all patients were divided into the following groups:

Group I - 36 patients who underwent cystectomy using the so-called sandwich technique, where the following components were layered on the bottom of the treated bone defect: the first layer - lincomycin powder, the second layer - bone-plastic microgranules «BS,» the third layer - platelet-rich plasma.

Group II also consisted of 28 people (16 men and 12 women). In all patients of this group, the cystic cavity was filled with the «OsteonTM II»preparation.

Group III (control group) consisted of 32 people (17 men and 15 women) who underwent cystectomy without implanting any materials, only filling with a blood clot.

To obtain a comparative assessment, all patients underwent radiological control before surgery and at 3, 6, and 12 months after surgery.

Studies have shown that when the defect is closed by a blood clot, osteogenesis processes develop in patients, however, complete restoration of bone tissue is not observed by the end of the period. Bone tissue deficiency in the operated area, the preserved trabecular structure along the edges of the defect contour, indicates ongoing osteogenesis. Consequently, patients need to be additionally prescribed medications that stimulate regenerative processes, which will ultimately lead to the complete restoration of its anatomical integrity, as well as the restoration of the dentofacial apparatus function.

Despite a number of advantages of osteoplastic materials, in particular, «OsteonTM II,» which contains natural (bovine) type I collagen, the granulated form of the preparation has the property of swelling. In the case of a slight increase in the number of microparticles of the preparation, some of it extends beyond the cavity of defects, tearing through the applied sutures. In such cases, repeated mobiliza-

tion was performed with suturing, followed by the appointment of anti-inflammatory therapy. It is also important to note that in small and medium-sized defects, complete bone tissue restoration occurs by the end of the 6th month, while in large defects (3 teeth or more), restoration was not observed by the end of the first year after surgery. The «BS» preparation proved to be an effective osteotransplant during the study, with microgranules no larger than 0.3mm in diameter. This material was introduced into the defect cavity after mixing with plasma, which was previously enriched with the patient's platelets. At the same time, the cavity was filled to 3/4 of its volume. Since the drug is combined with an antibiotic (linkomycin), it increases the effectiveness in preventing the risk of infection, which ultimately leads to complete bone regeneration.

The above is also confirmed by the conducted radiological studies. Consequently, the osteoplastic materials used based on tricalcium phosphate, sodium alginate, and porous hydroxyapatite affect the course of osteoregeneration processes in the area of the jaw bone defect, accelerating its rate. The «BS» preparation, enriched with OTP in combination with antibiotics, proved to be more effective, its effect on regeneration processes occurs regardless of the defect size. The healing period for large defects is 9-10 months, for small defects (within 1 tooth) by the end of the 6th month. The risk of developing secondary complications is also significantly reduced, and even with extensive defects, patients show no clear signs of inflammation, swelling, or fever. In the group of patients who used «OsteonTM II»as osteoplastic material after cystoectomy, this drug significantly activates regeneration processes, thereby demonstrating its effectiveness. The number of complications is also significantly reduced, only 2 cases. However, when studying the relationship between the drug's effect and the parameters of the cyst cavity, it was found that maximum effectiveness is achieved with sizes within 1-3 teeth, and with larger defects, the bioresorbable property of «OsteonTM II»is ineffective. Since the maximum rate of development of resorption processes manifests itself within 2-4 months of the postoperative period, this allows the use of this drug not only in the surgical treatment of small and medium-sized jaw defects but also in the treat-

ment of periodontitis.

When comparing the effectiveness of the osteoplastic materials used, we determined that for filling small and medium defects of the jaw bones, the osteoplastic preparation «OsteonTMII» is most effective, while for larger defects of the jaw bones, the material «BS» in combination with OTP and linkomycin is most effective.

According to the Haunsfield scale, changes in the optical density of bone tissue with defects of varying sizes do not significantly differ between them, but have a progressive nature of increasing. It has also been shown that, according to the study of optical density on the Haunsfield scale, the osteoplastic materials we used activate the processes of reparative regeneration in bone defects, and this effectiveness is significantly higher than with simple closure under a blood clot. At the same time, the optical density of bone tissue significantly exceeds the values of the control group.

The effectiveness of biocomposite materials has been proven clinically and experimentally by activating reparative regeneration processes, leading to the formation of a newly formed bone conglomerate that fills the defect cavity. The process of forming new bone structures, their maturation occurs through direct contact of the composite material with osteoblasts, by the end of which a newly formed bone callus with many components of the osteogenic complex develops.

By studying the results of a comparative analysis between the choice of osteoplastic material depending on the size of the defect, it was proven that for small and medium-sized defects, it is advisable to use preparations based on both calcium hydroxyapatite composite and biocollagen, in particular «OsteonTM II.» However, for large defects, the use of the «BS» preparation in combination with OTP and antibiotics is most effective.

The effectiveness of using these drugs in the treatment of various cystic formations reaches 96-98%, and an improvement in the indicators of periodontal stability of the studied teeth is also observed compared to the control group, approaching the values of healthy teeth.

Thus, based on the obtained results of the conducted clinical and experimental research, it can be concluded that the use of calcium hydroxyapatite and collagen-based osteoplastic materials in clinical practice is highly effective in the surgical treatment of not only jaw defects but also other pathologies of the dentoalveolar complex.

## RECOMMENDATIONS

1. To determine the effectiveness of osteoplastic preparations and assess their impact on osteogenesis processes, it is recommended to use our developed experimental model of surgical intervention, which involves implanting the studied material into an artificially created bone tissue defect. To study osseointegration, biocompatibility, and toxic properties of these materials, it is recommended to implant them under the skin of the experimental animal.
2. The most optimal osteoplastic material was «Bioactive Glass» in combination with PRP and antibiotic. This substance becomes fully saturated with blood, tightly filling bone defect cavities of various sizes, and ensures preservation of the wound volume throughout the entire recovery process.
3. «Bioactive Glass» combined with PRP and antibiotic proved to be the most versatile material for surgical treatment of defects complicated by the development of purulent processes.
4. When using osteoplastic materials, it is necessary to consider the size and volume of cavity defects. For small and medium defects (within 1-3 teeth), «OsteonTM II»is recommended. For filling large defects (extending beyond 3 teeth), «Bioactive Glass» in combination with PRP and antibiotic is recommended due to its long resorption period.
5. During the experiment, the osteoplastic material «OsteonTM II»demonstrated the following characteristics: a slower rate of resorption osteogenesis against a background of significant inflammatory process compared to «Bioactive Glass» in combination with PRP and antibiotic.

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