

Features of the process of bone tissue regeneration in complex treatment of lower jaw injury

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Abstract. The article presents the results of a study of mandibular trauma, as well as treatment methods. Several methods for treatment, features of the process of bone tissue regeneration during complex treatment are discussed. In the period from 2008 to 2021, 231 patients with mandibular fractures who were treated in the department of the Bukhara Regional Multidisciplinary Medical Center were studied. All patients were divided into two groups: a comparison group (traditional treatment) and this group (treatment of complex pathologies). To make the correct diagnosis, modern methods of x-ray, microbiological and laboratory research were used. Analysis of the results of traditional and special treatment showed a clear advantage of the latter in terms of optimizing the process of bone tissue restoration in cases of damage to the lower jaw.

1 Introduction

The main objective of surgical replacement of bone defects of the jaws is the prevention of postoperative complications, optimization and stimulation of the processes of reparative osteogenesis. Treatment of patients with impaired reparative regeneration of bone tissue is an urgent problem. Nature has maximally optimized the process of bone restoration after mechanical damage, however, the frequency of unsatisfactory results of treatment of fractures remains high (up to 30%) [1].

Reparative bone regeneration is a complex biological process that involves spatial and temporal interactions of numerous cell types, extracellular matrix, and several hundred genes [1, 3, 5]. In modern medicine, the problem of optimizing the reparative regeneration of bone tissue is of great importance, which is associated with the development of such areas of healthcare as disaster medicine, military medicine, due to local armed conflicts, increased traumatism, as well as due to its use in dental rehabilitation, including elderly and senile people, modern technologies:

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augmentation of the alveolar processes (parts) of the jaws, dental implantation, etc. [2, 7,8].

Causes of impaired bone tissue regeneration. The possibility of using such physical factors as electromagnetic and laser radiation, electrical and acoustic effects was assessed. Particular attention is paid to the use of low-frequency ultrasound. It has been shown that the use of low-frequency ultrasound to optimize bone tissue regeneration is a promising direction, but is not widespread in clinical practice. The question of optimal ultrasound parameters and application points also requires further study [1, 2, 3, 5, 9].

In modern dental practice, surgical treatment methods are often used in patients with periapical and periodontal foci of odontogenic infection, jaw cysts, dystopia and retention of third molars, as well as in the treatment of patients with partial or complete loss of teeth using dental implantation. The implementation of these surgical interventions in most cases is associated with trauma to the bone tissue of the jaws, as well as the formation of defects in them, the speedy healing of which should be an integral task of dental treatment, as it is aimed at the speedy dental rehabilitation of patients. Therefore, the issues of regeneration of bone tissue of the jaws during their fractures, the development of issues of optimizing effects on reparative osteogenesis are relevant for modern medicine and dentistry [1, 2, 4, 10].

Purpose of the study: to study the effect of complex pathogenetic therapy on the regenerative processes of bone tissue in fractures of the lower jaw.

2 Experimental part

In accordance with the stated goal and objectives of the study, a comprehensive examination and treatment of patients with fractures of the lower jaw and their purulent-inflammatory complications using medications such as serratapeptidase, azithromycin, exophage, foldboat and low-frequency ultrasound on the area of damage is indicated.

This study included the results of examination and treatment of 231 people. Among them, 182 patients with a unilateral fracture, 30 patients with a bilateral fracture and 19 patients with a closed fracture of the lower jaw, who were treated as inpatients in the Department of Maxillofacial Surgery of the Bukhara Regional Multidisciplinary Medical Center in the period from 2008 to 2020.

In group I - 122 patients with a fracture of the lower jaw, treated orthopedically and with traditional drug therapy with a solution of fibracillin at a dilution of 1:5000 and a solution of liquid bifidum bacteria (Table 1)

Group II - 109 patients with fractures of the lower jaw and their purulent-inflammatory complications, treated orthopedically and with special treatment with the prescription of serrata (Kusum Healthcare, India), exophage (Microgen NPO, Russia), azithromycin (Nika Pharm, Uzbekistan), foldboat by introducing them into the deep layers of the area of damage to the mandibular bone using low-frequency ultrasound. The age of the patients was in the range of 19-50 years. Among them, the majority were men - 102 (93.57%), there were 7 women (6.43.0%).

The control group consisted of 35 practically healthy people of identical age.

Table 1. Distribution of patients in group I by gender and age.

	Under 19 years old	20-29	30-39	40-49	50 years and older	Total
Men	6	32	40	21	16	115 (94,26%)
Women			2		5	7 (5,74 %)
Total	6	32	42	21	11	122 (100%)

Table 2. Distribution of patients in group II by gender and age.

	Under 19 years old	20-29	30-39	40-49	50 years and older	Total
Men	5	28	26	18	20	97 (86,0%)
Women			1	4	7	12 (14,0 %)
Total	5	28	27	22	27	109 (100%)

In most cases, patients with fractures of the lower jaw were injured as a result of the following types of injuries: domestic, sports, transport, street and industrial.

In 231 patients treated as inpatients, the fracture line was localized: central fracture - 22 (9.52%), in the canine area - 57 (24.67%), mental - 25 (10.82%), in the body area - 24 (10.38%), in the area of the angle of the lower jaw - 93 (40.25%), in the area of the articular process - 10 (4.32%). Moreover, based on radiological research methods, it was proven that the fracture line passed precisely through these areas of the lower jaw. From the data in the table below it is clear that out of 231 patients with fractures of the lower jaw and their complications, depending on various locations, unilateral fractures accounted for 182 (78.7%), bilateral - 30 (13%) and closed - 19 (8.3%).). Of the 231 patients with fractures of the lower jaw, 109 (1.9%) had complicated forms, such as post-traumatic osteomyelitis and phlegmon.

Table 3. The timing of patients' admission to the clinic from the moment of injury.

Fracture type	1th day	2th day	3th day	4th day	5th day	Final (n=231)
Unilateral fracture of the lower jaw	75	45	33	18	11	182 (78,7%)
Bilateral fracture of the lower jaw	9	6	6	2	7	30 (13 %)
Closed fracture of the lower part	7	3	6	2	1	19 (8,3%)
Total	91	54	45	22	19	231 (100%)

Based on an accurate analysis of literature data and the results of studies, the most common complaints of inflammation in patients with purulent-inflammatory complications of mandibular fractures are: pain, swelling, weakness, anxiety, sleep and appetite disturbances, increased body temperature, and also includes a satisfactory general condition patient (Fig. 1).

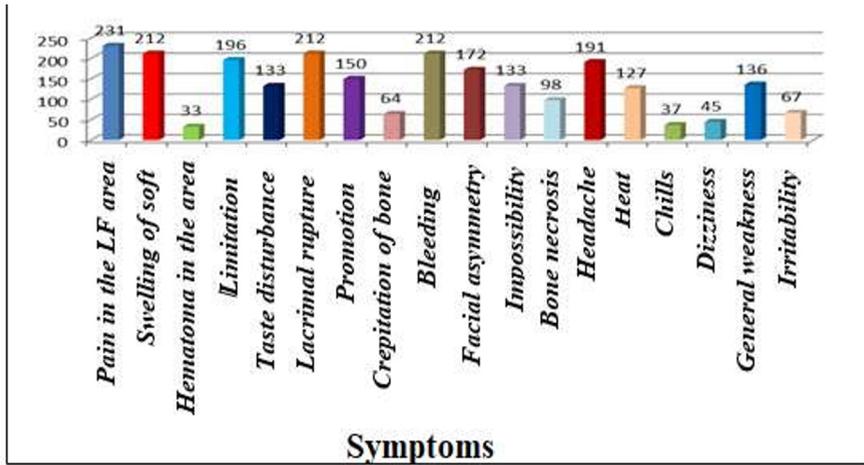


Fig. 1. Frequency of occurrence of general and local symptoms in the examined patients upon admission (abs).

Of all patients, 39.3% were hospitalized on the first day, within 2-3 days - 43% and in later periods - 17.7% of patients. To diagnose a fracture of the lower jaw and select the optimal treatment method, all patients underwent general clinical (collection of anamnesis, complaints, external examination of the maxillofacial area and oral cavity), neurological, radiological and laboratory methods of examination.

Due to the late immobilization of fragments of the lower jaw, the development of a purulent-inflammatory process in the fracture gap was registered in a group of patients admitted to the hospital late. The source of purulent infection was a tooth with necrotic pulp or a pathological process in the periapical tissues. As a result of this reason, acute post-traumatic osteomyelitis of the lower jaw developed.

When treating patients with mandibular fractures, traditional orthopedic immobilization and drug therapy were performed. Orthopedic treatment consisted of reposition and intermaxillary immobilization of fragments using various modifications of individually bent wire or standard tape splints with hooking loops.

Drug therapy included antibiotics, sulfa drugs, analgesics, and the introduction of sensitizing drugs into the gums. In patients of group II, in addition to the above, the following medications were prescribed: the enzyme preparation serrata, sextophage, florbiolact and the antibiotic azithromycin.

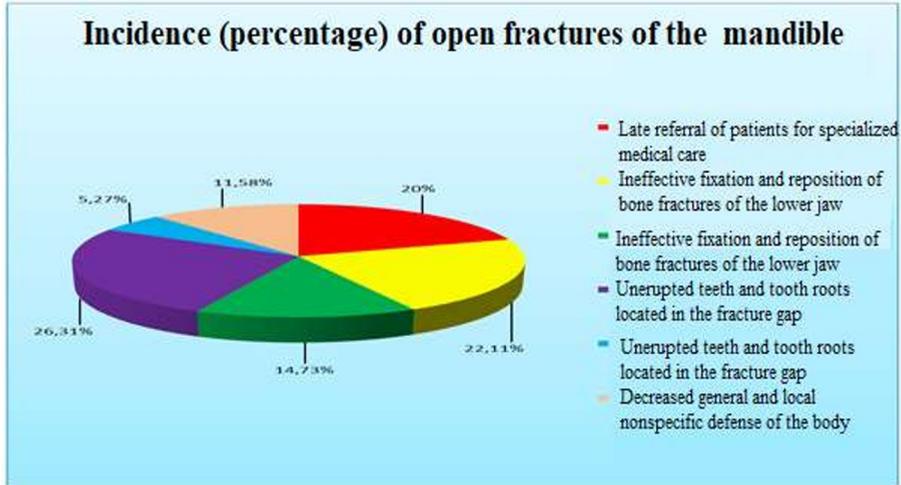


Fig. 2. Frequency of occurrence (in percentage) of open fractures of the mandible.

The above data were observed in open fractures of the mandible with unilateral, bilateral localization, in the canine area, angle of the jaw, with a central and mental fracture, fracture of the body of the mandible and with double fractures of the jaw.

The reasons for the development of post-traumatic osteomyelitis include the following: 1. Late request for specialized medical care in 33 patients with jaw bone fractures. 2. Ineffectiveness of fixation and reposition of fragments of the lower jaw in 20 patients. 3. Damage to soft tissue in the area of the fracture line in 22 patients. 4. In 12 patients, unerupted teeth and tooth roots were located at the edge of the fracture. 5. Damage to the nerves and choroid plexuses in 13 patients. 6. Decrease in general and local nonspecific defense of the body in 9 patients.

In fractures with displacement of bone fragments of the lower jaw in two or three places where the fracture line passes, damage to the nerves and blood vessels in the alveolar process is observed. As a result of this process, bone fragments move away from each other. During conservative orthopedic fixation of both jaws with Tigerstedt splints, bone fragments damage the neurovascular bundles, which leads to disruption of innervation and microcirculation. As a result, complications appear in the form of post-traumatic osteomyelitis.

Purulent-inflammatory complications in fractures of the lower jaw are among the most common pathologies of surgical dentistry and are distinguished by such features of the clinical course as a tendency to chronicity, the development of a spastic process, and the formation of purulent formations. The reasons for such a clinic are the changing virulence and diversity of microflora that causes inflammation, impaired immune response, and difficulties associated with effective treatment. Taking this into account, it was decided to conduct a study of the effect of complex therapy on the course of purulent-inflammatory complications in fractures of the mandible. The drugs chosen as complex therapy drugs were serrata, sextofak, florbiolact, in addition to traditional drug therapy (also including azithromycin) with treatment of the oral cavity with a solution of furacilin at a dilution of 1:5000, chlorhexidine and a solution of liquid bifidumbactrin.

Upon admission, the condition of all patients was assessed as severe or moderate. Laboratory data complemented the clinical picture of inflammation: leukocytosis and

a high percentage of band forms of neutrophils were characteristic. Every 5-6 patients have anemia. All patients after surgical sanitation received antibacterial drugs (traditional treatment). From the moment of admission, in addition to the specified treatment, patients of the main group were prescribed the drug Serrata, 3 tablets per day, and azithromycin, 1 tablet every 2 days.

Studies have shown the undeniable advantages of the drug serrata, both decongestant and anti-inflammatory, as well as having an effect such as fibrinolytic activity, which helps block a number of inflammatory mediators: bradykinin and histamine. In addition, the drug Serrata includes several positive properties: an effective effect on micro- and macroorganisms. In relation to both, this is explained by the fact that it affects microorganisms due to their joint participation in combination with other drugs that destroy microorganisms and activate the regenerative functions of the bone tissue itself, and in relation to the macroorganism, it acts by increasing the local factors of protection of the oral cavity. Directly reduces capillary dilatation and controls their permeability due to hydrolysis of inflammatory mediators. Improves the rheological properties of oral fluid. The drug Sextophage has the ability to specifically lyse bacteria such as staphylococci, streptococci (including enterococci), Proteus, Klebsiella pneumoniae, Pseudomonas aeruginosa and Escherichia coli.

Thus, in the complex treatment of patients with inflammatory complications of mandibular fractures, the use of medications contributed to increasing the effectiveness of complex pathogenetic therapy. Thanks to the bacteriolytic ability of the sextophage, the oral cavity was cleansed of microorganisms, which was manifested by the cessation of pus separation, subsidence of swelling and pain.

The broad-spectrum antibiotic azithromycin, having a bactericidal effect on aerobic and anaerobic gram-positive and gram-negative bacteria, helped reduce the growth and reproduction of bacteria in the oral cavity, as well as a decrease in the activity of peptidotranslocase and protein synthesis in patients with purulent fractures of the lower jaw. The probiotic florbiolact, administered orally and topically into a postoperative wound using a low-frequency ultravibrating device Stomaton MM in the treatment of patients of group II, promotes the synthesis of substances with antibacterial activity and increases the body's immune reactivity.

The proteolytic enzyme serrata has a fibrinolytic, anti-inflammatory and anti-edematous effect on the purulent-inflammatory process. In addition to oral administration, this drug, through long-wave ultravibration 26.5 kHz of the Stomaton MM device, ensured the absorption of the drug deep into the damaged tissue during the vibration process, eliminating the source of infection at the site of inflammation. The combined use of the above drugs accelerates the process of callus formation in the area of damage to the integrity of the bone tissue of the lower jaw, thereby helping to reduce bed days by 1-3 times.

One of the modern methods of examining patients with fractures of the lower jaw and face is the radiological diagnostic method. Currently, this examination method includes many research methods, namely radiography of the jaw bones in different projections, computer and magnetic resonance imaging. To achieve this goal, in the departments of maxillofacial surgery of the Bukhara Regional Multidisciplinary Medical Center and in the laboratory of the Department of Microbiology and Virology of the Tashkent State Dental Institute, we examined 231 patients with fractures of the lower jaw and their complicated forms (Figures 3-4-5).

All subjects were divided into the following groups: Group I - 122 patients who underwent only conventional radiographic examination methods in different projections; Group II - 109 subjects who underwent computed tomography of the lower jaw; Magnetic resonance imaging and radiography, CT, MSCT were used for examination; Group III - 35 practically healthy people - was compared with the main group and the comparison group.

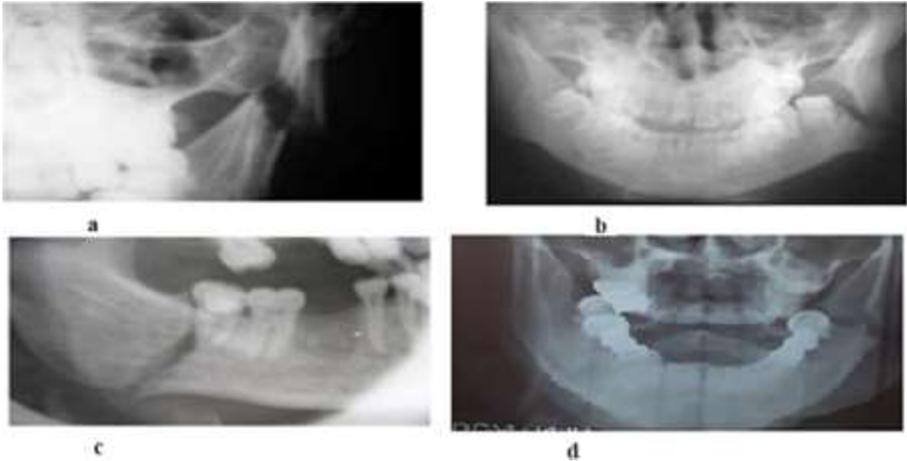


Fig. 3. Radiographs of patients with fractures of the lower jaw, performed in different projections: a, b-lateral; c, d- overview.



Fig. 4. Computer tomograms of patients with mandibular fractures.

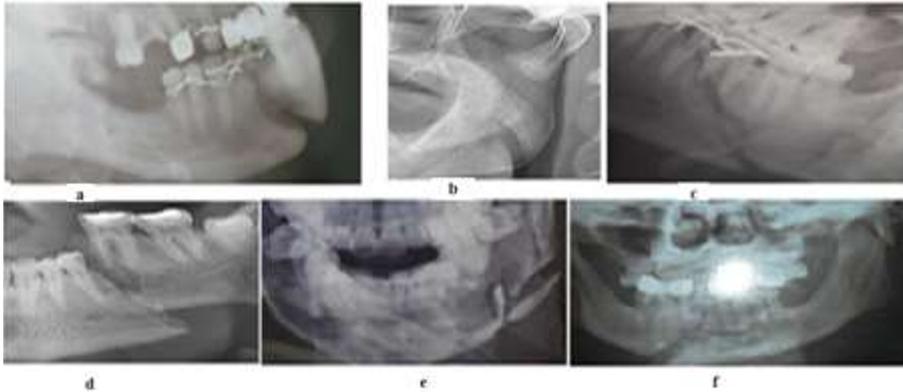


Fig. 5. Computer tomograms of mandibular fractures with 3D reconstruction.

Ultrasonic aerosol treatment of the oral cavity for fractures of the lower jaw was carried out using a generator of low-frequency ultrasonic vibrations "STOMATON MM" with a specially designed acoustic unit and waveguides having an axial groove through which the sonicated solution is supplied to the end of the waveguide.

Operating modes of the device: operating frequency - 26.5 kHz, amplitude of movement of the working end of the waveguide 40-50 μm , ultrasound intensity about 10 W/cm², flow rate of sonicated solution up to 20-40 ml/min.

The following solutions were used as a liquid acoustic medium when carrying out this method: in group I - chlorhexidine, fibracillin 1: 5000, bifidum bacteria. The control group did not receive the ultrasound treatment and those medications that were used for special treatment. In the main group of patients, the probiotic foldboat and exophage phage were used. The procedure for treating the oral cavity was as follows: a solution of the probiotic foldboat was injected into the wound using a tupuna soaked in it and a connected "STOMATON MM" apparatus.

The manipulation was carried out on a dental chair. A waveguide with a diameter of 3-5 mm was used, the distance from the end of the waveguide to the wound surface was up to 3-4 cm.

During the sounding, the torch was gradually moved along the entire length of the damaged bone tissue, so that the impact on the surface was carried out for at least 10-15 seconds over an area of 1.5 cm². The angle of inclination of the waveguide relative to the surface of the fracture zone does not matter, since aerosol particles hitting the surface of the liquid at any angle will excite acoustic flows propagating parallel to the sounded surface.

The ultrasound time was up to 3 - 5 minutes. The solution consumption per treatment averaged from 20 to 40 ml. Thus, in the complex treatment of purulent-inflammatory complications of mandibular fractures, physical methods are of great importance, since they are the most effective, economical and inexpensive methods. In order to study the effectiveness of physical treatment methods, the study examined the prevention of purulent-inflammatory complications in mandibular fractures, the potential pathogenicity of microorganisms isolated from the oral cavity, and the effect of low-frequency ultrasound on the oral microflora in patients with mandibular fractures. During surgical treatment, the energy of low-frequency ultrasonic vibration is split into foldboat contact in pathologically damaged tissues, has a nonreflex effect, improves blood and lymph circulation, activates biochemical processes and modifies

metabolism, while accelerating reparative processes in cells. An optimal result was observed in the wound tissue at the end of treatment with a good clinical effect in patients treated with a solution of the probiotic foldboat.

Clinical observations showed that after complex treatment of purulent-inflammatory complications of mandibular fractures with the use of Serrat, Sextophage and foldboat, azithromycin, general and local symptoms of inflammation decreased significantly and in a shorter time compared to the comparison group (traditional therapy).

In patients with purulent-inflammatory complications of mandibular fractures, on the 8-10th day of treatment in the traditional way, a dynamic decrease in general and local clinical signs is observed. At the same time, a more pronounced decrease in general and local clinical signs was observed in patients of group II. Along with this, in patients of this group, clinical signs of intoxication were eliminated faster, pulse, body temperature (on days 3-4), sleep and appetite normalized, dyspeptic symptoms disappeared (on days 4-5) and local signs, such as swelling of the soft tissues, disappeared earlier. tissues, pain disappeared, exudation from the wound decreased significantly on days 4-5.

Purulent-inflammatory complications in fractures of the lower jaw are the most common pathology of surgical dentistry and are distinguished by such features of the clinical course as a tendency to chronicity, the development of a spastic process, and the formation of purulent formations. The reasons for such a clinic are the changing virulence and diversity of microflora that causes inflammation, immune response disorders, and difficulties associated with effective treatment.

Analysis of the obtained and generalized values of the research results of all groups gave us satisfactory and relatively satisfactory results. For fractures of the lower jaw of group I, which received traditional treatment, solutions of chlorhexidine, fibracillin at a dilution of 1:5000, bifidum bacteria and cefazolin were used as therapy. In addition, several laboratory tests are advisable for additional therapy. The result in this group was adequate fixation of fragments of the lower jaw, antibacterial therapy, etc. For purulent-inflammatory complications of mandibular fractures in group II, Serrata, Sextophage and foldboat, azithromycin was used as therapy. These drugs were complemented by the action of the ultrasound device "STOMATON - MM". In group II, treatment outcome indicators were close to absolutely good when patients in group II were tested. All immunological parameters and factors of local protection of the oral cavity were close to normal. Summarizing all groups, we can conclude that in group II the results of treatment of these patients do not differ from those of actually healthy people.

3 Conclusion

The prevalence of purulent-inflammatory complications of mandibular fractures among the population is 1.9%; according to the location of fractures, 9.52% are central fractures, 24.7% are fractures of the canine area, 10.8% are mental areas, 10.8% - on the body of the lower jaw, in 40.2% of cases there were fractures in the area of the angle of the lower jaw;

The use of ultrasonic aerosol treatment of the oral cavity for the prevention of inflammatory complications of mandibular fractures improves blood and lymph circulation in pathologically damaged tissues, accelerates reparative processes in

cells, reduces the development of post-traumatic purulent complications, and increases the effectiveness of treatment.

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