



## EXPERIENCE OF INVESTIGATION OF MICROBIOCENOSIS OF THE ORAL CAVITY IN EXAMINED PATIENTS WITH FRACTURES OF THE LOWER JAW

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**Annotation.** The results of complex pathogenetic therapy of patients with injuries of the mandibular bone have been published. The scientific novelty is based on the study of microbiocenosis of the oral cavity. The study concluded that the role of local immune factors including lysozyme phagocytic activity of neutrophils, in the development of complications of mandibular fractures was proved, and that these factors are the main cause of an increase in the concentration of pathogenic microflora and unfavorable prognosis of the disease. In addition, the high clinical, immunological and microbiological efficacy of the complex treatment of traumatic osteomyelitis of the lower jaw was determined

**Key words:** Traumatic injuries of the lower jaw, microbiocenosis of the oral cavity, dysbiosis, immunocorrective therapy, laboratory studies.

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**INTRODUCTION.** On a global scale, in order to study the issues of etiology, prevention and complex pathogenetic therapy of purulent-inflammatory complications of mandibular fractures, numerous scientific studies are being conducted, including the creation and improvement of various methods of complex treatment of purulent complications of mandibular fractures. The basic rules of the paradigm of mandibular fracture and purulent-inflammatory complications are associated with the practical application of scientific achievements. The conducted studies show a high prevalence of traumatic lesions of the facial skeleton and risk factors for its development, combined with an insufficient level of surgical care for patients with purulent-inflammatory complications of mandibular fractures, which requires the development of reasonable methods, including preventive and complex pathogenetic therapy. Prevention and treatment of patients with mandibular fractures and purulent complications is still an urgent problem in medical practice.

Analytical information of a number of researchers demonstrates the fact that 40% of all patients treated in the departments of maxillofacial surgery are patients with injuries of the maxillofacial region. In the structure of damage to the facial

skeleton, fractures of the lower jaw are most common, accounting, according to domestic and foreign clinics, from 70% to 85%. At the same time, the frequency of inflammatory complications remains high (from 9% to 40%), which greatly complicates the treatment of patients with this pathology.

The most common and formidable complication of mandibular fractures is traumatic osteomyelitis. According to various authors, its frequency reaches 30%. It is noteworthy that the victims with fractures of the lower jaw are practically healthy people. Consequently, the main task in their treatment is to create optimal conditions for the manifestation of the action of the biological law of reparation.

The species composition of pathogens and their sensitivity to antibiotics tend to change periodically. Without knowledge of the microflora and its sensitivity to antibiotics, the effectiveness and safety of antibiotic therapy becomes problematic. The spectrum of microorganisms tends to expand and increase the role of pathogens - opportunistic bacteria that manifest their pathogenic properties against the background of immunosuppression. The development of purulent-inflammatory complications of the lower jaw is a serious problem not only medical, but also social, since it poses a real threat to the life and health of the patient. And last but not least: the extension of the treatment of patients, which significantly reduces the ability of patients to work. With a long course of the disease, patients may develop mental and depressive changes.

Thus, a deep analysis of domestic and foreign literary sources showed that research on the problems of diagnosis and complex pathogenetic treatment of mandibular fractures and complications of purulent inflammation is not enough. All of the above determined the purpose of this study.

**The purpose of the study:** to study the microbiocenosis of the oral cavity in the examined patients with mandibular fractures.

**Materials and methods.** The object of the study were 231 patients aged 19-50 years and older with inflammatory complications of mandibular fractures.

In group I - 122 patients treated with a fracture of the lower jaw, orthopedic method and the appointment of traditional drug therapy with a solution of furacillin at a dilution of 1:5000 and a solution of liquid bifidumbacterin (Table 1)

Group II - 109 patients with a mandibular fracture and their purulent-inflammatory complications, treated orthopedically and with special treatment with serrata (Kusum Healthcare, India), sextophag (Microgen NPO, Russia), azithromycin (Nika Pharm, Uzbekistan), florbiolacta by introducing them into the deep layers of the damaged area using low-frequency ultrasound. The age of the patients ranged from 19 to 50 years. Among them, the majority was represented by men - 102 (93.57%), women - 7 (6.43.0%).

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

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

	Under 19	20-29	30-39	40-49	50 years and above	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	20-29	30-39	40-49	50years and above	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: household, sports, transport, street and industrial injuries.

**Table 3**  
**Terms of admission of patients to the clinic from the moment of injury.**

Fracture type	Day 1	Day 2	Day 3	Day 4	Day 5	Total (n=231)
Unilateral mandibular fracture	75	45	33	18	11	182 (78,7%)
Bilateral mandibular	9	6	6	2	7	30 (13 %)

fracture						
Closed mandibular fracture	7	3	6	2	1	19 (8,3%)
Total	91	54	45	22	19	231 (100%)

Of all patients, 91 (39.3%) were hospitalized on the first day, within 2-3 days - 41 (17.7%) and at a later date - 41 (17.7%) patients were hospitalized for emergency reasons. To diagnose a mandibular fracture and select the optimal method of treatment, all patients underwent general clinical (history, complaints, external examination of the maxillofacial region and oral cavity), neurological, radiological and laboratory methods of research.

Statistical processing of the digital material of the results of the study was carried out by the generally accepted variational-statistical method using an application package using a Pentium IV computer. The data obtained were processed using a statistical analysis software package with the calculation of the arithmetic mean (M), standard deviation ( $\sigma$ ), standard error (m), relative values (frequency, %). A significance level of  $p < 0.05$  was taken as statistically significant.

### **Results and its discussion.**

To accomplish the tasks set, the microorganisms of the oral mucosa of the patients of the examined groups were studied. Thus, the presence of microorganisms in the oral cavity of patients with fractures of the lower jaw led to a microbiological imbalance, growing in the dynamics of traditional treatment, and manifested by a decrease in the number of symbionts and an increase in opportunistic microorganisms. Such microbiocenosis can contribute to the development of inflammatory diseases of the oral mucosa, which must be taken into account when planning treatment.

As shown by many researchers, purulent-inflammatory complications in mandibular fractures are more severe and bone tissue necrosis is observed more widely as a result of a greater number of associations of microorganisms in the wound compared to monoculture.

Moreover, the processes caused by associations of microorganisms are characterized by secondary local and general complications with severe interstitial edema and extensive tissue necrosis against the background of a reduced number

of cellular defense elements. The occurrence of complications in fractures of the lower jaw also depends on the amount and virulence of the microflora.

It should be noted that before using drugs in the complex treatment of patients with mandibular fractures *in vitro!* microbiological studies were carried out to determine the sensitivity to drugs (Table 4).

As can be seen from the table, the antiseptic solution of furacilin had a significantly significant bactericidal effect on 5 types of microorganisms, most of which were cocci. At the same time, the drug Chlorhexidine affected two types of microorganisms, these are *S.aureus* and *Klebsiellaspp.* Although bifidumbacterin is considered an antagonist of all tested microorganisms, it had the most pronounced effect on four types of microorganisms.

Preparations Sextafag and Serrata had an antibacterial effect on most microorganisms. At the same time, the antibiotic Azithromycin and the probiotic Florbiolact had a pronounced antibacterial effect on 6-7 species of 12 microorganisms.

Serrata - in most cases, it is mainly prescribed to improve the digestive process of the gastrointestinal tract, that is, to break down the food substrates used by patients.

Serratiopeptidase is a proteolytic enzyme isolated from the non-pathogenic intestinal bacterium *Serratia E15*. It has a fibrinolytic, anti-inflammatory and anti-edematous effect.

**Table 4.**  
**Characteristics of the sensiyivity of microorganisms to drugs in traditional treatment (in vitro)**

Group of microorganisms	Furaciline	Chlorhexidine	Biphidumbarterine
<b>Str. salivarius</b>	20,0 ± 0,3*	15,0 ± 0,2	15,0 ± 0,1*
<b>Str. mutans</b>	21,0 ± 0,3*	16,0 ± 0,2	15,0 ± 0,2*
<b>Str. mitis</b>	18,0 ± 0,2	18,0 ± 0,2	18,0 ± 0,2*
<b>Staph.aureus</b>	19,0 ± 0,2*	19,0 ± 0,3*	13,0 ± 0,1
<b>St.epidermidis</b>	20,0 ± 0,3*	13,0 ± 0,2	19,0 ± 0,3*
<b>St.saprothiticus</b>	20,0 ± 0,2*	16,0 ± 0,2	14,0 ± 0,2
<b>Esch. coli JII</b>	12,0 ± 0,1	16,0 ± 0,2	20,0 ± 0,4*
<b>Esch. coli JIH</b>	11,0 ± 0,1	15,0 ± 0,1	25,0 ± 0,4*
<b>Prot. vulgaris</b>	15,0 ± 0,1	14,0 ± 0,1	15,0 ± 0,2
<b>Klebsiella</b>	21,0 ± 0,3	22,0 ± 0,3*	21,0 ± 0,3*

<b>Pseudomonas</b>	13,0 ± 0,1	14,0 ± 0,1	15,0 ± 0,2*
<b>Candida albicans</b>	11,0 ± 0,1	13,0 ± 0,1	12,0 ± 0,1

Note: Significant differences in drug sensitivity with conventional treatment (p<0.05-0.01).

In addition to reducing inflammation in purulent-inflammatory complications of mandibular fractures, serratiopeptidase reduces pain by reducing the release of painful amines from inflamed tissue. By hydrolyzing bradykinin, histamine and serotonin, serratiopeptidase directly reduces capillary dilation and controls their permeability. Serratiopeptidase blocks plasmin inhibitors and thus increases the fibrinolytic activity of the mucosa.

The antibiotic azithromycin, as expected, has a wide spectrum of antibacterial action and has a significant effect on the tested microorganisms (table 5). A pronounced antibacterial effect on cultures of fungi Candida, Esherichiacolli, Rroteusspp, Pseudomonasspp was noted.

In patients with a fracture of the lower jaw, the formation and development of dysbiotic growth syndrome occurs due to a violation of oral hygiene and a decrease in local protective factors in the mucous membrane.

Florbiolact is designed to reduce the dysbiotic pattern in the oral cavity of patients. As can be seen from Table. 5, the probiotic Florbiolact has a pronounced antagonistic effect on most of the studied groups of gram-positive and gram-negative microorganisms.

**Table 5**

**The sensivity of microorganisms to drugs in special treatment under invitro conditions!**

<b>Group of microorganisms</b>	<b>Cextraphag</b>	<b>Cerrata</b>	<b>Azitromici n</b>	<b>Florbiolact</b>
<b>Str. salivarius</b>	11,0 ± 0,1*	0	16,0 ± 0,2*	18,0 ± 0,2*
<b>Str. mutans</b>	12,0 ± 0,1	0	15,0 ± 0,1*	20,0 ± 0,3*
<b>Str. Mitis</b>	0	0	15,0 ± 0,2	19,0 ± 0,2*
<b>Staph.aureus</b>	11,0 ± 0,1*	13,0 ± 0,1*	21,0 ± 0,3*	21,0 ± 0,3*
<b>St.epidermidis</b>	11,0 ± 0,1*	11,0 ± 0,1*	22,0 ± 0,3*	20,0 ± 0,3*
<b>St.saprofithicus</b>	16,0 ± 0,2*	12,0 ± 0,1*	14,0 ± 0,2*	22,0 ± 0,3*
<b>Esch. coli JII</b>	16,0 ± 0,2	12,0 ± 0,1*	15,0 ± 0,2*	25,0 ± 0,4*
<b>Esch. coli JH</b>	13,0 ± 0,1	0	21,0 ± 0,3*	26,0 ± 0,4*
<b>Prot. vulgaris</b>	16,0 ± 0,2*	11,0 ± 0,1*	22,0 ± 0,3*	15,0 ± 0,2
<b>Klebsiella</b>	16,0 ± 0,2*	11,0 ± 0,1*	16,0 ± 0,2	11,0 ± 0,1

<b>Pseudomonas</b>	13,0 ± 0,1	0	21,0 ± 0,3*	12,0 ± 0,1
<b>Candida albicans</b>	15,0 ± 0,2*	0	22,0 ± 0,3*	0

Note: significant differences in sensitivity to drugs in complex treatment ( $p < 0.05-0.01$ ).

Thus, based on microbiological studies of the effectiveness of the complex full antibacterial action of drugs on microorganisms that form the basis of the microflora of the oral cavity, the following conclusions can be drawn.

Most of the drugs used for the complex treatment of patients with mandibular fractures have shown high efficiency in terms of antibacterial activity.

In addition to antibacterial activity against microorganisms present in the inflammatory process, Serrata is also prescribed to improve digestion in these patients.

**Changes in the results of clinical, microbiological and immunological parameters after traditional treatment of mandibular fractures.** After the 1st and 7th days of treatment, an analysis of the state of the microflora of the oral cavity of patients showed that the dysbiotic changes that occurred in the oral cavity on the 1st day not only did not improve, but, on the contrary, deepened.

Despite this, some positive changes were observed in the quantitative indicators of streptococci. It should be borne in mind that pathogenic strains of staphylococci appear in the oral cavity.

Microbiological studies show that after 14 days of traditional treatment, positive changes were noted in all indicators of the microflora of the oral cavity, in particular, they relate to anaerobic microflora and cocci. It should be emphasized once again that in relation to gram-negative microflora, on the contrary, a negative picture was recorded, that is, an increase in the rate of its release was observed.

Analysis of microbiological studies of the oral cavity in the dynamics of the disease (30th day) showed that the positive changes noted on the 14th day were fully preserved, and in some indicators were more positive, especially in lactobacilli. It should be noted that these indicators remained negative for fungi of the genus *Candida*.

As can be seen from Table. 6, after conventional treatment, a relative decrease in local immunity was found for all studied parameters. At the same time, changes in the immune status were significantly manifested in the dynamics of treatment on

the 1st and 7th days. From the 14th day of traditional treatment and on the 30th day of treatment, a significant positive improvement was noted. But one cannot speak of a complete recovery of immunodeficiency indicators.

**Table 6**

**Local immune parameters of the oral cavity in the dynamics of conventional treatment in patients of the 1<sup>st</sup> control group with a mandibular fracture (n=122)**

Indicators	Norm	In patients with MF	During treatment			
			1 д	7 д	14 д	30 д
Lizosimy mg%	18,5±0,3	11,6±0,2	12,1±0,1	11,5±0,1	12,2±0,1*	15,1±0,1*
NFF %	56,2±2,2	46,1±1,5	45,0±0,2	41,2±0,1	47,0±1,1*	48,2±1,1*
sIgA $\lambda$	2,2±0,1	1,4±0,1	1,3±0,1	1,2±0,1	1,5±0,1*	1,6±0,1*

Note: Local immune parameters of the oral cavity in the dynamics of traditional treatment ( $p < 0.05-0.01$ ).

**Changes in the results of clinical, microbiological and immunological parameters after complex treatment of mandibular fractures.**

The next study group consisted of patients with mandibular fractures who received complex treatment in addition to conventional treatment. The materials of these studies are presented in Table 7, which showed that on the 7th day there were positive changes in the entire microflora studied in the oral cavity of patients. It should be noted that the quantitative indicators of staphylococci in this group of patients began to shift in a positive direction on the 7th day. An analysis of microbiological studies conducted in the same patients on the 14th day showed that the positive changes noted on the 7th day not only persisted, but also improved.

In patients receiving complex treatment, the dysbiotic picture was practically eliminated in all respects on the 14th day. It is gratifying to note that these positive changes in the oral cavity of patients with mandibular fractures were also noted for pathogenic strains of staphylococci and fungi of the genus *Candida*.

In patients receiving complex treatment, the indicators of the 30th day of treatment, observed on the 14th day, not only remained after treatment, but also improved. It is believed that these positive changes may have occurred due to the combined use of general and topical probiotics.



Indicators of local protective factors of the oral cavity in patients with mandibular fractures in the dynamics of complex treatment are presented in Table 7. It was noted that the decrease in immunity was significantly expressed on the 1st and 7th days of illness. However, from the 14th day of the disease, a significant improvement in all indicators of the local immune pattern was noted, and on the 30th day of complex treatment, all indicators of local oral defense factors approached those of a group of healthy people.

**Table 7**

**Local immune parameters of the oral cavity in the dynamics of complex treatment in patients of the II control group with a mandibular fracture**

**(n=109)**

Indicators	norm	In patients with mandibular fracture	During treatment			
			Day 1	Day 7	Day 14	Day 30
Lyzsocim Mg%	18,5±0,2	11,5±0,3	14,0±0,2	12,5±0,2	16,1±0,1*	17,0±0,2*
HΦΦ %	56,2±2,1	45,3±1,5	48,1±1,2	41,0±1,1	51,2±1,4*	54,0±1,3*
sIgA g/l	2,1±0,1	1,4±0,1	1,4±0,1	1,5±1,2	1,7±1,1*	1,9±1,2*

Note: Local immune parameters of the oral cavity in the dynamics of complex treatment (p<0.05-0.01).

It is interesting to note that the dynamic change in the state of indicators of local oral defense factors in patients with mandibular fractures has a direct correlation with changes in dysbiosis in the oral cavity, both after traditional and after complex treatment.

At the same time, 100% of the examined patients had an abundance of oral biocenosis and the predominance of colonized gram-positive microflora in terms of species composition. In healthy people, the main part of the microflora of the oral cavity was made up of representatives of the genus *Streptococcus*, and the dominant type was *Str. salivarius*.

It can be seen that the study of the colonization of various biotopes of the oral cavity by microorganisms makes it possible to understand the direct processes occurring in the oral cavity, which are undoubtedly associated with the state of the oral fluid, and are also due to the presence of a complex of cell receptors, while microorganisms can attach to their surface in a complex way.

The next group of studies of resistance to colonization by microorganisms in various biotopes of the oral cavity consisted of patients with mandibular fractures. The data obtained in these studies are presented in Table 8. The table shows that significant changes in colonization in these patients were observed in almost all biotopes.

At the same time, the following changes are observed in almost all biotopes: 1. A significant decrease in the colonization properties of streptococcal strains; 2. Against this background, the characteristic of colonization in cultures of staphylococci and fungi of the genus *Candida* sharply increased; 3. It is alarming that the colonizing property of lactobacillus cultures has decreased in all biotopes, and in some biotopes, for example, cheeks and palate, it will disappear altogether; 4. A stable state of colonization among gram-negative microflora is observed in *Escherichia*

**Table 8**  
**State of colonization resistance of oral microorganisms in patients with mandibular fractures. (n=231)**

№	Group of microorganisms	Areas of the oral cavity			
		Gingiva	Tangue	Cheek	Palate
1	Lactobacillus	2,0±0,1*	1,30±0,1*	0	0
2	Streptococcussalivarius	4,60±0,2*	3,85±0,2*	2,30±0,1	2,0±0,1*
3	Streptococcusmutans	3,10±0,2	3,0±0,1	1,60±0,1	1,0±0,1
4	Streptococcusmitis	2,85±0,1	2,0±0,1*	2,10±0,1	1,0±0,1
5	Staphylococcus	4,85±0,3*	4,15±0,2	3,0±0,2	2,30±0,1*
6	Escherichia	2,0±0,1	1,80±0,1	1,6±0,1	1,15±0,1
7	Klebsiella	2,80±0,1	1,15±0,1	0	0
8	Candida	2,15±0,1	3,0±0,2	4,10±0,1*	4,0±0,1*

Note: colonization resistance of oral microorganisms in patients with mandibular fractures (p<0.05-0.01)

### Conclusions.

Thus, based on the study of the state of microflora in patients with fractures of the lower jaw, local protective factors, features of the colonization of microorganisms in the oral cavity, the following conclusions can be drawn:

1. The prevalence of purulent-inflammatory complications of mandibular fractures among the population is 1.09%, according to the localization of fractures, 9.52% fall on central fractures, 24.7% - on fractures of the canine region, 10.8% - on

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

2. In patients with a fracture of the lower jaw, the quantitative and qualitative composition of the microflora of the oral cavity was dysbiotic, 3-4 types of bacterial associations, non-anaerobic spore-forming bacteria were detected in 97% of cases, the number of *Staphylococcus aureus* increased by 2.15 times, a decrease in lactobacilli was observed by 2, 5 times;

3. With the development of complications of fractures of the lower jaw, a significant quantitative increase from the normal limits of gram-positive cocci *Staphylococcus aureus*, *Staphylococcus epidermidis*, *Staphylococcus spp.*, *Peptostreptococcus spp.* indicators of local immune factors, including lysozyme, phagocytic activity of neutrophils, sIgA index, in the development of complications of mandibular fractures were studied and it was found that the lysozyme index decreased by 1.6 times, the phagocytic activity of neutrophils - by 1.24 times, and sIgA - 1.5 times;

4. After the traditional treatment of mandibular fractures, the results of clinical, microorganism, biological and immunological parameters were compared on the 1st and 7th days of treatment, while there was no positive dynamics of dysbiotic changes in the state of the microflora of the oral cavity of patients; in the group of patients who received the recommended complex treatment, the total number of CFU anaerobes increased by 1.6 times, the existing lactoflora increased by 1.7 times, positive results were also noted in terms of facultative microflora and approached the norm, pathogenic staphylococci were completely eliminated, the process of bone regeneration tissue restored;

5. 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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