



MICROECOLOGY AND LOCAL FACTORS OF ORAL CAVITY PROTECTION IN PATIENTS WITH MANDIBULAR FRACTURES

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Resume,

The results of the microbiological study indicate that 59.54% of patients have pronounced qualitative and quantitative changes in the biotope of the oral cavity in the direction of identifying representatives of conditionally pathogenic microflora - coccal flora and yeast-like fungi of the genus Candida. According to our study, in the groups of examined patients, there was insufficient function of local immunity of the oral cavity, manifested by a reduced content of sIgA and an increase in lysozyme in the oral fluid, with more pronounced changes in patients with bilateral fracture of the mandible and dysbiosis towards coccal flora and candidiasis.

Keywords: oral microflora, local factors of the oral cavity, fractures of the lower jaw, microbiocenosis, dysbiosis

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The frequent development of abscesses and phlegmon in the head and neck is due to the high prevalence of chronic focal odontogenic, tonsilogenic infections, as well as infectious and inflammatory lesions of the skin and oral mucosa [2,5,7,8,12,18,22,25,26,28,31]. The most common form of septic inflammation is odontogenic purulent-inflammatory diseases [1,3,5,6,9,10,11,14,17]. The incidence of infectious and inflammatory complications in fractures of the jaw bones remains high [9,10,4,13,16,20,22,24,25,29]. Most authors associate the increase in patients with maxillofacial phlegmon with a decrease in the body's resistance, a feature of the microflora of purulent facial wounds and the sensitization of the macroorganism in the presence of chronic odontogenic foci of infection [1,2,21,22,29]. To study this problem, the most promising are immunological studies conducted at the systemic and local levels. This will significantly expand the understanding of the pathogenesis of purulent-inflammatory diseases of the maxillofacial region [5,6,7,22,31].

The purpose of the study. To assess the level of contamination of microbial flora and the

degree of immunological reactivity of the body in complicated fractures of the mandible.

The object and subject of the study studied 231 patients with inflammatory complications in fractures of the mandible.

In order to conduct microbiological studies in this contingent of patients, oral fluid was taken by flushing from the oral mucosa (by rinsing). For the subsequent seeding of a certain volume of flushes on the surface of differential diagnostic nutrient media, we used highly selective nutrient media produced by the Indian company "Xi Media". The etiologically significant pathogens were those sown at a concentration of more than 10⁴-10⁵ CFU/ml. Further identification and differentiation were determined by Bergy's [2001]. The basis of this bacteriological diagnosis was the isolation and identification of the pathogen.

The results of the study. The data of the conducted studies have shown that patients with fractures of the lower jaw have a violation of the natural microbiocenosis of the oral cavity with the appearance of representatives of



conditionally pathogenic microflora. In 87 patients (41.2%), mainly coccal flora was detected, the proportion of which averaged $82.5 \pm 6.4\%$ of strains, in 136 patients (64.4%) *Streptococcus* spp., in 55 (26.0%) - *Staphylococcus* spp., in 54 (25.5%) - *Peptostreptococcus* spp., in 60 gram-negative

cocci of sem were isolated in 28.4% of patients. *Neisseriaceae*, in 16 patients in 7.5% of cases gramnegative sticks of sem. *Enterobacteriaceae* - in 13 (6.16%), *Pseudomonas* spp. - in 3 (1.4%), *Actinomyces* spp.- in 12 (5.6%), *Corynebacterium* spp. - at 11 (5.2%).

Table 1.

The nature of the microbiocenosis of the oral cavity in the focus of the fracture of the lower jaw

| № | Groupsofmicrobes | Controlgroup | | Inpatients | |
|----|-----------------------|-----------------------------|--------|-------------------------|------------|
| | | Frequencyofallocation, % | Title | Frequencyofallocation,% | Title |
| 1 | Lactobacilli | 94 | 10^4 | 85 | 10^5 |
| 2 | Streptococcispp. | 25 | 10^5 | 92 | 10^8 |
| 3 | Staphylococcispp. | 30 | 10^3 | 85 | 10^6 |
| 4 | St.aureus | 2 | 10^3 | 52 | 10^4 |
| 5 | Fusobacteria | 30 | 10^3 | 75 | 10^5 |
| 6 | Peptostreptococcuspp. | 25 | 10^2 | 52 | 10^3 |
| 7 | Pseudomonasspp. | 0 | 0 | 12 | 10^{318} |
| 8 | Corynebacterium spp. | 30 | 10^2 | 56 | 10^3 |
| 9 | Candidaspp. | 30 | 10^3 | 61 | 10^4 |
| 10 | Neisseriesspp. | 80 | 10^4 | 54 | 10^3 |
| 11 | Leptotrichia | 94 | 10^3 | 52 | 10^7 |
| 12 | Bifidobacteria | 80 | 10^2 | 83 | 10^5 |
| 13 | Escherichia LP | 10 | 10^2 | 30 | 10^3 |

In general, the results of the microbiological study indicate that 59.54% of patients have pronounced qualitative and quantitative changes in the biotope of the oral cavity in the direction of identifying representatives of conditionally pathogenic microflora - coccal flora and yeast-like fungi of the genus *Candida*.

We found that all these microorganisms were detected mainly in the form of 3-, 4-, 5-component associations, respectively, in 25.0%, 40.8%, 26.5% of cases, both with unilateral fractures of the LF and with bilateral fractures of the LF.

As a result of a comparative assessment of the microbial contamination of various oral cavity biotopes and their corresponding zones in the examined individuals, the following was established. Representatives of facultative-anaerobic and obligate-anaerobic flora with the predominance of the latter (more than 75% of the isolated species) were found at all sites. Microbial contamination ranged from 10^5 to 10^8 . The microflora was more diverse, the largest number of potentially aggressive species of gram-negative bacteria such as *Prevotellaintermedia*, *Porphyromonasgingivalis*, *Actinobacillus*spp, *Fusobacterium* spp. and others were sown in



considerable quantities. After 7 days after the traditional treatment, the indicators changed slightly. However, in the dynamics of observation at 14 and 30 days, the number of these microorganisms decreased significantly and in some cases until their complete elimination (Prevotellaintermedia - 102 and 103, respectively; Porphyromonasgingivalis - 104 and 104, respectively; Actinobacillus spp. - 103 and 104), respectively.

At the same time, it should be noted that coccal flora (up to 108) began to be sown in the oral cavity, in particular, species capable of supporting inflammatory processes of the oral mucosa: *St. aureus*, *S. sanguis*, *S. milleri* and others.

In the main observation group, *Staphylococcus aureus* was sown in 75.0% (in 54), epidermal staphylococcus – in 43.0% (in 31) and hemolytic streptococcus - in 23.6% (in 17). In addition, *Candida* fungi were found on the mucous membrane, which reached the most significant values. It is obvious that the high content of microorganisms is primarily due to the difficult self-cleaning of this area with saliva and food.

Of the 72 examined, monoculture was found in 38 people (52.7%), and associations (2-3 microbes each) in 34 people (47.2%).

Thus, it can be seen from the conducted studies that in patients with a fracture of the lower jaw, the microflora of the oral cavity undergoes a deep microecological restructuring. This is manifested by the change of dominant species, a sharp increase in the ecological significance of opportunistic streptococci, staphylococci, fungi and enterobacteria, an increase in species diversity due to the appearance of filler species in the community. All of the above characterizes dysbiosis.

It is interesting to note that although the biocenoses subject to the most profound changes are the cheek mucosa, the structural restructuring of the microflora architectonics captures all anatomical areas, which makes it possible to speak of a fracture of the lower jaw

not only as a local inflammatory process in the tooth tissues, but also as a disease of the oral cavity as a whole.

The next group of our studies consisted of patients with fractures of the lower jaw, who, along with traditional therapy, received special treatment. The materials of these studies are presented in Table 2, from the table it can be seen that already on the 7th day in the oral cavity of patients there are positive changes in all the studied flora. Although it should be noted that in this group of patients, pathogenic strains (*St. aureus*) staphylococcal analysis of microbiological studies in the same patients on day 14 indicates that the positive changes that were noted on day 7 not only remained, but improved even more. On the 14th day after treatment, microbiological indicators changed as follows: the prevalence of *Staphylococcus aigeis* in patients of the 2nd group was 2 times less, 2.5 times less common – *E. coli* and almost 2 times – *Candida* fungus. As for the level of contamination with conditionally pathogenic microorganisms, it was an order of magnitude lower in patients after special treatment.

Consequently, the use in combination with the appointment of drugs Serrate, sectophage additional to traditional drug therapy (including also Azithromycin) in the period of the dynamics of the disease contributes to the reduction of pathogenic microflora.

In the same patients who received special treatment for 21 days, the picture of dysbiosis was actually eliminated in all indicators. It is gratifying to note that these positive changes in patients with fractures of the lower jaw in the oral cavity were also noted in relation to pathogenic strains of staphylococci and fungi of the genus *Candida*.

It is interesting to note that in these same patients, after special treatment on the 30th day, it is noted that the positive changes in the flora of the oral cavity that took place on the 21st day not only persisted, but deepened even more. Apparently, these positive changes have occurred due to the use of general and local eubiotics.



Table 2

Characteristics of oral flora in patients with fractures of the lower jaw in dynamics with special treatment Lg (M ±m) KOE/ml.

| | Groupsofmicrobes | The number of microbes in 1 ml of saliva | | | |
|----|-----------------------|--|------------|------------|-------------|
| | | with the dynamics of treatment | | | |
| | | 7 days | 14days | 21 days | 30days |
| 1 | Lactobacillus | 2,10 ± 0,1 | 2,30 ± 0,1 | 4,10 ± 0,2 | 4,0 ± 0,2* |
| 2 | Peptostreptococcuspp. | 4,10 ± 0,2 | 4,0 ± 0,2 | 5,10 ± 0,3 | 5,15 ± 0,3* |
| 3 | St.aureus | 1,60 ± 0,1 | 1,30 ± 0,1 | 0,70± 0,2* | 0,35± 0,1* |
| 4 | Staf. epidermal | 4, 0 ± 0,2 | 3,60 ± 0,2 | 5,0 ± 0,2 | 4,90 ± 0,2 |
| 5 | S.salivarius | 5,0 ± 0,3 | 4,60 ± 0,3 | 5,10 ± 0,3 | 5,0 ± 0,3 |
| 6 | S.mutans | 3,60 ± 0,2 | 2,85 ± 0,1 | 3,0 ± 0,1 | 3,10 ± 0,1 |
| 7 | S.mitis | 2,15 ± 0,1 | 3,10 ± 0,1 | 2,60 ± 0,1 | 2,0 ± 0,1 |
| 8 | E.coli | 3,0 ± 0,1 | 3,30 ± 0,2 | 2,60 ± 0,1 | 2,0 ± 0,1* |
| 9 | Candida | 3,0 ± 0,1 | 2,85 ± 0,1 | 2,60 ± 0,1 | 2,30 ± 0,1* |
| 10 | Klebsiellaspp. | 1,0 ± 0,2 | 1,80 ± 0,1 | 2,0 ± 0,1 | 1,20 ± 0,1 |

Notes: statistically significant differences at the significance level p<0.05

Thus, summarizing the studies conducted as a whole, the following conclusion was made: prevention of inflammatory complications with a fracture of the mandible should be based, first of all, on ensuring cleanliness, as well as preventing the reproduction of aggressive microflora. It is also important to have an inhibitory effect on the components of inflammation and a stimulating effect on regenerative processes.

The main phenotypic characteristics of resident bacteria that provide the potential for their participation in the development of inflammatory diseases of the maxillofacial region are: adhesion - adhesion to the surface of soft tissues; protection - the ability to persist under the action of the protective forces of the macroorganism; invasiveness – provided by aggression enzymes; toxicity – due to the effects of endo– and exotoxins [5,9,10,16,24,30]. Therefore, in surgical dentistry, in the treatment of inflammatory complications, as well as for

their prevention, antibacterial therapy is always present. All this can be done by using the drug Serrate, sextophage in addition to traditional drug therapy (including Azithromycin), a solution of furacillin in a dilution of 1:5000, chlorhexidine and a solution of liquid bifidumbactrin and conducts physical methods of treatment, low-frequency ultrasound on the area of damage.

The results of the studies showed that all 45 people, patients with a fracture of the lower jaw, uncomplicated form and the appointment of traditional drug therapy with a solution of furacillin in a dilution of 1:5000 and a solution of liquid bifidumbacterin, who developed dysbiosis, despite the prescribed preventive measures immediately upon admission to the hospital.

For studies of microbial contamination, both its intensity and the presence of certain types of pathogenic microorganisms were taken into account.



The dynamics of changes in microbiological parameters in this group of patients was as follows: the total microbial contamination of the oral cavity was significantly higher (106-7), studies showed that on the 7th day of observation, the highest rates of *Staphylococcus aureus* (106-7 CFU/ml), *Escherichia coli* (103-105 CFU/ml) and *Candida albicans* (104-106 CFU/ml) on the 14th day, their microbial indicators increased even more: *Staphylococcus aureus* to 108 CFU/ml, *Escherichia coli* to 104-105 CFU/ml and *Candida albicans* to 105-106 CFU/ml.

In the dynamics of observation in patients after the course of traditional treatment, certain qualitative changes occurred, especially by 21 and 30 days. that is, there was a decrease in the concentration of isolated microorganisms compared to the primary results. At the same time, it should be noted that pathogenic strains of staphylococci began to be sown in the oral cavity.

As for the prevalence of the content of individual microorganisms, patients with a mandibular fracture, uncomplicated form, *Staphylococcus aureus* was sown in 100% of cases, *Staphylococcus haemolyticus* and *Streptococcus spp* were in 2nd place in prevalence.

Based on the conducted studies, it was concluded that high microbial contamination of the oral cavity is a risk for the development of inflammation, and an increase in the titer of pathogenic microorganisms indicates the development of inflammation. The most aggressive against the development of purulent inflammation are *Staphylococcus aureus*.

It is possible to reduce the number of complications by conducting prognostic studies, which at the stages of the latent period may indicate the development of the inflammatory process, and thereby, due to the timely implementation of therapeutic and preventive measures, reduce the intensity of the development of inflammation in the injury area.

Thus, the results of microbiological studies showed that at 7-21 days % of the

seeding rate of species microflora and the level of microbial contamination in 3 groups was approximately at the same level. On the 21st-30th day in the dynamics of treatment, microbiological indicators changed as follows: the prevalence of *Staphylococcus aureus* in group 1 patients treated with orthopedic method and the appointment of traditional drug therapy with a solution of furacillin in a dilution of 1:5000 and a solution of liquid bifidumbacterin (without complex treatment) increased by 75%; in group 2, where patients with a fracture of the mandible treated with orthopedic method and the appointment of the drug Serrata, sextophage additional to traditional drug therapy (including Azithromycin), furacillin solution in dilution 1:5000, chlorhexidine and liquid bifidumbacterine solution were used, 80% was reduced; and in group 3 (appointment traditional drug therapy with a solution of furacillin in a dilution of 1:5000 and a solution of liquid bifidumbacterin) – increased by 60%.

The seeding rate of *Staphylococcus haemolyticus* in group 1 doubled, in group 2 - by 20%, in group 3-by 45%. *Streptococcus spp.* – in the 1st group - 35.0%, in the 2nd – by 20% and in the 3rd - by 40%. *Escherichia coli* - in the 1st group - twice, in the 2nd – by 20%, In the 3rd – has not changed. *Candida albicans* increased by 22% in group 1, remained at the level of initial data in group 2 and 30% in group 3.

Thus, the prevalence of staphylococci, the main indicators of suppuration, in patients with fractures of the lower jaw increased significantly only in the 1st and 3rd groups. When studying the prevalence of streptococci-microorganisms of the saprophytic series - no significant increase was observed in all groups. As for *E. coli*, in the 1st and third groups, the prevalence rates doubled, and in the 2nd group they did not change at all.

Very interesting data were obtained when studying the prevalence of *Candida albicans* – the highest indicators were obtained in group 1, where traditional drug therapy was used. At the same time, in the 2nd group, where



special treatments were used, the prevalence of *Candida albicans* remained at the level of the initial data. In the 3rd group – on the 7,14,21th day, the indicators increased even more. Based on the conducted studies, it was concluded that the use of the drug Serrata, sextophage in addition to traditional drug therapy (including Azithromycin), a solution of furacillin in a dilution of 1:5000, chlorhexidine and a solution of liquid bifidumbacterin, prevents the development of purulent-inflammatory complications in patients.

One of the indicators of the human body's resistance to pathological conditions is the level of some factors of nonspecific protection (Mamaeva E.V. 2006). The suppression of local immunity of the oral cavity affects both the occurrence of inflammatory diseases and the course of the process of inflammation in them (Grudyanov A. I. 2010.,Khomenko L. A.2011).

To study humoral immunity in the oral cavity, it is generally accepted to determine the content of such an indicator as sIgA in the oral fluid. The key role in the antimicrobial protection of the oral cavity is played by the enzyme lysozyme, which destroys bacteria and viruses. A decrease in lysozyme activity leads to an excessive growth of pathogenic microflora. Therefore, in order to assess the relationship between the factors of local immunity and nonspecific protection in the oral cavity, it is necessary to get an idea of the nature of changes in the indicators of local immunity by the content of sIgA and nonspecific protection by the level of lysozyme in the oral fluid (Pukhova O. S. 2004; Romanenko E. G. 2013).

In all examined patients with fractures of the mandible, in parallel with microbiological By research, we have also conducted a study of the state of local factors of oral cavity protection.

The materials of these studies, which are also studied in the dynamics of traditional and special treatment.

According to our study, in the groups of examined patients, there was insufficient function of local immunity of the oral cavity, manifested by a reduced content of sIgA and an

increase in lysozyme in the oral fluid, with more pronounced changes in patients with bilateral fracture of the mandible and dysbiosis towards coccal flora and candidiasis. It is known that *Candida* spp. they themselves have the ability to inhibit the development of immune reactions, have relatively low immunogenic properties, so the activity of the humoral immune response to them is not as significant as to viruses and many bacteria.

The results of patients during the entire observation period on changes in lysozyme, PHI (phagocytic index) and sIgA were studied. At the initial examination in the 1st group on the 1st day, the amount of sIgA was $1.3 \pm 0.1 \text{g/l}$, on the 7th day - $1.2 \pm 0.1 \text{g/l}$, on the 14th day - $1.5 \pm 0.1 \text{g/l}$, on the 30th day - $1.6 \pm 0.1 \text{g/l}$.

In our study, a change in the activity of lysozyme, one of the indicators of nonspecific immunity, was determined. At the initial examination

, lysozyme activity was $12.1 \pm 0.1\%$ in group 1 patients, $11.5 \pm 0.1\%$ in day 7 patients, $12.2 \pm 0.1\%$ on day 14, and $15.1 \pm 0.1\%$ on day 30 in group 1 patients.

The phagocytosis index was $45.0 \pm 0.2\%$ in the 1st group on the 1st day, 41.2 ± 0.1 on the 7th day, 47.0 ± 1.1 on the 14th day, 48.2 ± 1.1 on the 30th day.

At the same time, immunodeficiency was significantly expressed on the 1st and 7th days after treatment. Starting from the 14th day of traditional treatment, and especially on the 30th day, there is a significant improvement in the picture. However, it is not necessary to speak about the complete restoration of immunodeficiency indicators. Apparently, this is due to the presence of severe stress, eating disorders and metabolic disorders, i.e. metabolism.

After the treatment, there was a significant change in the concentration of phagocytosis, sIgA and lysozyme in the oral fluid towards their normalization, which changed more markedly in the second group, and persisted throughout the observation period.



The treatment had a positive effect on the state of local immunity of the oral cavity, but the proposed complex made it possible to achieve stabilization in the indicators of sIgA and lysozyme during the entire observation period. The use of complex treatment contributed to an increase in the indicators of local immunity in the oral cavity in all comparison groups. At the same time, after 20-30 days of observation, the level of lysozyme increased by almost 91% (compared to the control group), a significant increase in the content of lysozyme was observed by the 14th day after treatment ($p < 0.05$),

whereas on the 30th day its level was significantly higher than the initial one. AF in patients with mandibular fractures before treatment was significantly less compared to the control, on the 14th and 30th days after treatment it significantly increased ($p < 0.05$) and approached the values in the control group. The level of sIgA in patients was significantly higher in comparison with the control, on the 14th and 30th days after treatment it significantly increased ($p < 0.05$) and approached the values in the control group, which in our opinion, of course, can be explained by the anti-inflammatory effect of the drug used in special treatment. After the treatment, there was a significant change in the concentration of phagocytosis, sIgA and lysozyme in the oral fluid towards their normalization, which changed more markedly in the second group, and persisted throughout the observation period. Thus, the obtained research results indicate the stimulating effect of the conducted therapeutic and preventive measures on the natural

antimicrobial system of oral cavity protection in patients with fractures of the lower jaw. Such a phenomenon should be considered as a positive process that contributes to increased resistance in the oral cavity in patients with fractures of the lower jaw.

Conclusions. High microbial contamination of the oral cavity is a risk for the development of inflammation, and an increase in the titer of pathogenic microorganisms indicates the development of inflammation. The most aggressive against the development of purulent inflammation are *Staphylococcus aureus*.

The developed complexes of therapeutic and preventive measures in patients with fractures of the mandible with dysbiosis towards the coccoid flora are pathogenetically justified and increase the effectiveness of treatment by 2-3 times.

Fracture of the mandible in patients is accompanied by the development of severe stress, which actually causes the development of immunodeficiency in all studied indicators. Apparently, it is the development of immunodeficiency that leads to the development of the syndrome of excessive growth of microbes in the oral cavity in these patients.

Summing up the results of the study, the following conclusion can be made in patients with fractures of the mandible to improve the effectiveness of treatment, it is necessary to clarify the composition of the microbiota and include in the treatment regimen the drugs we have proposed (*serrate*, *sextophage*, *azithromycin*) additional to traditional drug therapy, which have proven to be highly effective.



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