

## Evaluation of the Effectiveness of Complex Orthopedic Treatment in patients with Oral Dysbiosis

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### ABSTRACTS

**Aim:** To study the clinical effectiveness of the proposed complex of therapeutic and preventive measures for oral dysbiosis in patients with removable orthopedic structures.

**Methods:** We divided 45 patients with removable dentures into 3 groups: those, who received a removable prosthesis "Ftorax"; those, who received a removable prosthesis "Belakryl - EGO" and those, who received the same prosthesis as the second group, but also they used an adhesive dental gel with a probiotic and a synbiotic in the form of a lozenge. In addition, general hygiene measures were recommended for patients of all three groups. Then zones of inflammation were measured and a bacteriological examination of the oral mucosa was carried out.

**Results:** Two weeks after the start of the study, the inflammatory zone in the second group was significantly smaller compared to the first (410.4 mm<sup>2</sup> in the upper jaw, 376.1 mm<sup>2</sup> in the lower jaw and 236.6 mm<sup>2</sup> in the upper jaw and 200.5 mm<sup>2</sup> in the lower jaw, respectively). The best results were obtained in the third group (190.5 mm<sup>2</sup>, 133.3 mm<sup>2</sup>).

**Conclusion:** A comparative study of the of the acrylic base polymer "Belacryl-EGO" with the analogue "Ftorax" showed good results in assessing the total area of the inflammatory process of the tissues of the prosthetic bed. The use of the symbiotic and probiotic also led to better results.

**MeSH words:** Removable dentures, acrylic base plastic, oral dysbiosis, prevention, synbiotics, probiotics.

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### INTRODUCTION

It has been proven that removable orthopaedic denture structures have long been complex irritants of the oral mucosa (OM). Competent implementation of the technological stages of manufacturing removable denture structures, their timely correction during the adaptation period, recommendations for professional and individual hygiene of the oral cavity and dentures themselves do not always guarantee the absence of microbial colonization on the surface of bases by opportunistic and pathogenic microorganisms, as well as an inflammatory reaction of denture-supporting tissues. The dentist is faced with the question of the dysbiotic and inflammatory complications prevention when choosing a base material for a removable denture in orthopedic treatment. The subject of this work is to study the effect of the base material of removable orthopedic structures on the condition of the denture-supporting tissues and to prove the effectiveness of the proposed by the author's comprehensive method for the prevention of oral dysbiosis, which affects the success of all prosthetics and the quality of dental health. Studies aimed at investigating these problems are especially important for improving the effectiveness of orthopedic treatment of patients.

The need of patients for orthopedic treatment with removable dentures remains at a fairly high level. The effect of removable dentures on the tissues and organs of the dentition is diverse, as well as the response of the body. The development of the reactions of the denture-supporting tissues is based on various pathogenetic mechanisms due to the properties of the materials from which the prosthesis is made, the methods of its fixation, the nature of the transfer of chewing pressure, the size of

the basis of the prosthesis. The responses of the prosthetic bed are determined, on the one hand, by the nature, intensity and duration of the stimulus, and on the other, by the reactivity of the organism.

Much importance in modern dentistry is paid to the study of normal human microflora, since its participation in the processes of digestion, metabolism, synthesis of vitamins, the formation of the immune status and general nonspecific resistance of the organism has been proven. The course, outcome and prognosis of orthopedic treatment depend on microecological well-being. Microbiocenosis of the oral cavity, both in health and pathology, is represented not only by bacteria, but also by viruses, fungi, yeast, spore forms of microorganisms, etc., which, like in other parts of the body, are in complex ecological relationships. The microflora of the oral cavity is a highly sensitive indicator system that reacts with quantitative and qualitative shifts to changes in the state of various organs and systems of the human body. Under the influence of various factors, including removable denture structures, the microflora composition can change, which can lead to the development of dysbiosis and inflammatory changes in the oral cavity, which worsen the results of orthopedic treatment. It was found that in patients with dysbiotic changes, the hygienic condition of the oral cavity and removable dentures deteriorates. This, in turn, dictates the need to develop and introduce into dental practice means and methods that normalize the biocenosis.

In recent years, there has been an active development of modern drugs - synbiotics, which include a complex of probiotics and prebiotics. Stimulation of probiotics with prebiotics contributes to the regulation of metabolic activity, the development of beneficial microbiota,

inhibition of potential pathogens and the provision of immunomodulatory effects.

Thus, the search and development of new complex methods for the prevention of oral dysbiosis arising from the use of removable dentures remains one of the topical issues of modern dentistry, due to the widespread prevalence of this problem.

The aim of this research work is to study the clinical effectiveness of the proposed complex of therapeutic and preventive measures for oral dysbiosis in patients with removable orthopedic structures.

## MATERIAL AND METHODS

To achieve this goal, 45 patients of an equivalent age group were examined. They had various features of the prosthetic bed, both anatomical-topographic and anatomical-physiological, which are important for treatment in the clinic of orthopedic dentistry. The study was conducted at the department of propaedeutic dentistry of VSMU named after N.N. Burdenko. The patients were divided into 3 groups:

1. the first group consisted of 15 patients who received a removable plastic prosthesis made of acrylic plastic "Ftorax" (Kharkov, Ukraine). When cleaning and disinfecting removable dentures, patients used a soft toothbrush, children's toothpaste;
2. the second group consisted of 15 patients, for them removable dentures from acrylic base polymer "Belakryl - EGO" (Belgorod, Russia) were made. It was recommended to use a soft toothbrush, baby toothpaste. "DentaseptinAg<sup>+</sup>" was used for disinfection of removable dentures (exposure in solution for disinfection for 20 minutes, once a day);
3. the third group consisted of 15 subjects who had removable plate prostheses made of acrylic base polymer "Belakryl - EGO" (Belgorod, Russia). Patients were advised to use a soft toothbrush, children's toothpaste and disinfectant solution "DentaseptinAg<sup>+</sup>" for cleaning and disinfection (exposure in solution for disinfection for 20 minutes, once a day). Patients of the 3rd study group were trained in the technique of using an adhesive dental gel with a probiotic at home, which they applied with a thin layer on the inner surface of the removable denture base. A synbiotic was prescribed in the form of a lozenge, once a day for 20 days.

All patients underwent examination of the oral mucosa under the bases of removable dentures and a bacteriological examination of the mucous membrane of the prosthetic bed.

We studied the total area of inflammation zones in patients to analyze the indicators of orthopedic treatment with removable dentures from an acrylic base of various manufacturers and the correctness of the chosen method of therapeutic and preventive measures. In the study, the Schiller-Pisarev solution was used to identify areas of overload of the mucous membrane under the bases of removable dentures, which includes: 2.0 ml KY; 1% solution of toluidine blue; 1.0 ml Y2; 40.0 ml of distilled water. The Schiller-Pisarev solution, after being compressed by the base of the removable prosthesis, interacted with the epithelial cells of the oral mucosa. However, in areas of increased chewing load, the staining

intensity of the mucous membrane of the prosthetic bed directly depended on the degree of the inflammatory reaction. To increase the reliability of the obtained results of the study, a 1% solution of nuclear dye – toluidine blue was applied to the mucous membrane of the prosthetic bed. This solution has the property of staining the nucleoli of the epithelial cell's nuclei, after which there was a contrasting of the color intensity. In order to create a load on the mucous membrane of the prosthetic bed with the prosthesis, the examined patient was offered to perform chewing movements. To determine the area of inflammation, we tightly applied a transparent polyethylene film to the mucous membrane of the prosthetic bed, onto which the colored area of the inflammation zone was transferred using a gel pen. The resulting image was superimposed on graph paper and the area of inflammation was calculated.

Thus, the use of this technique to study the macrohistochemical reaction made it possible to assess the state of the mucous membrane under the bases of removable dentures made of acrylic polymer after 1 day, 1 week, 2 weeks and 21 days after the application of the orthopedic structures.

Microbial adhesion is undoubtedly a condition for increasing microbial colonization and the development of tissue invasion. The material used for the manufacture of removable dentures enters into a complex interaction with the tissues of the patient's prosthetic bed and may have an adverse effect on the oral cavity state. A detailed study of the properties of the materials used, which determine the adhesion of microbes, especially representatives of the microflora of the oral cavity, is important, since different groups of microbes (viruses, fungi, bacteria) affect the state of the tissues of the oral cavity and the removable dentures themselves. The research studied all microorganisms of the OM, which grew on the growth media on the day of placement of removable dentures, after 10 days and 1 month. Lindsay's special quantitative method was used for blotting, which made it possible to establish the "critical number" of microbes in a certain volume of the clinical sample under study and to carry out etiological differentiation. A smear was taken from the oral mucosa of the patients with a sterile cotton swab moistened in 0.5 ml of the sterile 0.9% sodium chloride solution (Ph 7.6-7.8) in order to conduct a microbiological study of the aerobic flora. The procedure was carried out in compliance with antiseptic rules, in the morning, on an empty stomach. Subsequently, the material was delivered for research at a temperature of 50C within 3.5-4 hours in test tubes with a specially prepared transport medium.

## RESULTS AND DISCUSSION

We analyzed the results of the orthopedic treatment performed on the condition of the mucous membrane of the prosthetic bed in patients of 3 groups. We were able to establish that under the bases of removable prostheses one day after application, the number of total areas of the inflammatory response did not differ significantly. It was 1372.9 mm<sup>2</sup> in the upper jaw and 850.2 mm<sup>2</sup> in the lower jaw.

Seven days after fixation of removable dentures, an

unequal decrease in the studied parameter was noted in all three groups.

Two weeks after the use of removable dentures in patients of the 1 group, who used removable plate prostheses made of acrylic polymer "Ftorax", the dynamics of changes in the total area of inflammation zones of the mucous membrane was 410.4mm<sup>2</sup> in the upper jaw and 376.1 mm<sup>2</sup> in the lower jaw. In patients of the 2 group, who used removable polymer prostheses of acrylic group "Belacryl - EGO" these values were 236.6 mm<sup>2</sup> in the upper jaw and 200.5 mm<sup>2</sup> in the lower jaw. In patients of the 3 group with removable dentures made of acrylic polymer "Belacryl - EGO" with the use of the proposed treatment and preventive complex, the areas of the pathological process was the smallest. The values obtained were 190.5 mm<sup>2</sup> in the upper jaw and 133.3 mm<sup>2</sup> in the lower jaw.

At 21 days after fixation of removable dentures, the assessment of the state of the mucous membrane of the prosthetic bed showed that the smallest area of inflammation zones was observed in the 3rd group of patients with removable dentures from "Belacryl - EGO" and who used an adhesive dental gel with probiotic and synbiotic in the form of a lozenge. This value was 59.2 mm<sup>2</sup> in the upper jaw and 46.5 mm<sup>2</sup> in the lower jaw. In the 1 group of patients, this value was 120.1 mm<sup>2</sup> in the upper jaw and 116 mm<sup>2</sup> in the lower jaw. In patients of the 2 group it was 104 mm<sup>2</sup> in the upper jaw and 96 mm<sup>2</sup> in the lower jaw. The use of acrylic base plastic "Belacryl EGO" as a structural material in removable prosthetics, a complex of therapeutic and preventive measures using a dental adhesive gel with a probiotic, in combination with a synbiotic in the form of a lozenge, made it possible to reduce the studied parameters. In addition, in patients of the 3 group, with an objective assessment, the oral mucosa became pale pink, the swelling disappeared, patients noted the absence of bad breath, the disappearance of itching and burning of the oral mucosa.

When assessing the quantitative and qualitative composition of the microbiocenosis of the oral mucosa, it was found that the following types of pathogenic and opportunistic microorganisms were identified in all groups of patients: Candida Albicans, St. Aureus, Str. Epidermidis,

Str. Piogenes, E. Coli, Neisseria, Ent. Faecalis, Klebsiella, Str. Pneumonia. Analysis of the obtained bacterial species in the test material, taken from the mucous membrane of the alveolar ridge in the studied 1 group, showed that 10 days after the observation of patients there was an increase in the growth of pathogenic and opportunistic flora, which was also recorded after 1 month of the study (table 1).

The revealed growth of pathogenic and conditionally pathogenic flora slightly changed downward after 10 days in the 1 group, which undoubtedly was a consequence of the use of a disinfectant solution for cleaning dentures (Table 2).

Table 3 shows the results of a study of patients who used a disinfectant solution for cleaning dentures and used an adhesive dental gel with a probiotic in combination with a synbiotic. On the 10th day of the study, the number of colonies of pathogenic flora decreased significantly, or was not detected at all. It was also noted that the degree of contamination of the test material was significantly reduced. After 1 month of our studies, the pathogenic flora almost not detected at all (Table 3).

Thus, based on the analysis of the results of the microbiological study, it can be concluded that in patients with oral cavity dysbiosis after orthopedic treatment with acrylic removable dentures, there was a slight decrease in the anti-infectious resistance of the oral cavity. Consequently, pathogenic and opportunistic flora is activated. It was found that after cleaning and disinfection of removable dentures made of "Belacryl - EGO" polymer with a disinfectant solution "DentaseptinAg<sup>+</sup>" and the use of our proposed complex in combination with the local application of an adhesive gel with a probiotic and the use of a synbiotic in the form of a lozenge, the microbial contamination significantly decreased and the qualitative and the quantitative composition of the microflora of the mucous membrane of the prosthetic bed changed. In addition, high efficiency has been shown against Candida albicans, which play an essential role in the development of an imbalance in the normobiocenosis of the mucous membrane.

Table 1: Analysis of the results of microbiological research in patients from the 1st group

Microorganisms	Before the study	10 days after the study	1 month after the study
Candidaalbicans	24,1% (10 <sup>2</sup> -10 <sup>5</sup> )	28,9% (10 <sup>3</sup> -10 <sup>4</sup> )	37,1% (10 <sup>3</sup> -10 <sup>5</sup> )
St. Aureus	35,8% (10 <sup>3</sup> -10 <sup>5</sup> )	37,9% (10 <sup>2</sup> -10 <sup>5</sup> )	39% (10 <sup>3</sup> -10 <sup>5</sup> )
Str. Epidermidis	9,49% (10 <sup>3</sup> -10 <sup>5</sup> )	11,68% (10 <sup>3</sup> -10 <sup>5</sup> )	16,71%(10 <sup>3</sup> -10 <sup>5</sup> )
Str. Piogenes	14,19%(10 <sup>2</sup> -10 <sup>5</sup> )	15,27% (10 <sup>5</sup> )	19,26% (10 <sup>5</sup> )
E.coli	28,4% (10 <sup>3</sup> -10 <sup>5</sup> )	31,9% (10 <sup>5</sup> -10 <sup>7</sup> )	36,1% (10 <sup>5</sup> -10 <sup>7</sup> )
Neisseria	11,8% (10 <sup>3</sup> -10 <sup>4</sup> )	12,2% (10 <sup>3</sup> -10 <sup>5</sup> )	15,1% (10 <sup>3</sup> -10 <sup>5</sup> )
Ent. Faecalis	16,3% (10 <sup>2</sup> -10 <sup>5</sup> )	17,1% (10 <sup>3</sup> 10 <sup>6</sup> )	19,9% (10 <sup>3</sup> -10 <sup>6</sup> )

Table 2: Analysis of the results of microbiological research in patients from the 2nd group

Microorganisms	Before the study	10 days after the study	1 month after the study
Candidaalbicans	35,9% (10 <sup>2</sup> -10 <sup>5</sup> )	26,3% (10 <sup>3</sup> -10 <sup>4</sup> )	24,1% (10 <sup>3</sup> -10 <sup>5</sup> )
St.aureus	34,9% (10 <sup>3</sup> -10 <sup>5</sup> )	26,7% (10 <sup>2</sup> )	14,2%(10 <sup>2</sup> )
Str.piogenes	8,41% (10 <sup>4</sup> -10 <sup>5</sup> )	7,16% (10 <sup>3</sup> -10 <sup>4</sup> )	6,02% (10 <sup>3</sup> -10 <sup>4</sup> )
Str.pidermidis	19% (10 <sup>3</sup> -10 <sup>5</sup> )	17% (10 <sup>2</sup> -10 <sup>3</sup> )	11,4% (10 <sup>3</sup> )
E.coli	22,7% (10 <sup>3</sup> -10 <sup>5</sup> )	15,6% (10 <sup>2</sup> )	13,3% (10 <sup>3</sup> )
Neisseria	7,6% (10 <sup>2</sup> -10 <sup>3</sup> )	6,4%(10 <sup>2</sup> -10 <sup>3</sup> )	5,1%(10 <sup>2</sup> -10 <sup>3</sup> )
Ent.Faecalis	17,9% (10 <sup>3</sup> -10 <sup>5</sup> )	12,5% (10 <sup>3</sup> -10 <sup>4</sup> )	2,1% (10 <sup>3</sup> )
Klebsiella	3,66% (10 <sup>3</sup> )	3,78% (10 <sup>2</sup> )	not detected
Str. Pneumonia	2,89% (10 <sup>4</sup> )	3,90 (10 <sup>3</sup> )	not detected

Table 3: Analysis of the results of microbiological research in patients from the 3rd group

Microorganisms	Before the study	10 days after the study	1 month after the study
Candidaalbicans	45,2% (10 <sup>3</sup> -10 <sup>5</sup> )	10,03% (10 <sup>2</sup> -10 <sup>3</sup> )	not detected
St.aureus	35,3% (10 <sup>3</sup> -10 <sup>5</sup> )	13,9% (10 <sup>2</sup> -10 <sup>3</sup> )	2,9%(10 <sup>2</sup> -10 <sup>3</sup> )
Str.piogenes	7,67% (10 <sup>3</sup> -10 <sup>4</sup> )	3,89% (10 <sup>2</sup> -10 <sup>3</sup> )	notdetected
Str.epidermidis	6,84%(10 <sup>2</sup> -10 <sup>5</sup> )	not detected	not detected
E.coli	21,7%(10 <sup>3</sup> -10 <sup>5</sup> )	4,79% (10 <sup>2</sup> -10 <sup>3</sup> )	not detected
Neisseria	5,2% (10 <sup>3</sup> -10 <sup>4</sup> )	1,9%(10 <sup>2</sup> -10 <sup>3</sup> )	not detected
Ent.faecalis	15,8% (10 <sup>3</sup> -10 <sup>5</sup> )	10,9% (10 <sup>3</sup> -10 <sup>4</sup> )	1,6% (10 <sup>2</sup> -10 <sup>3</sup> )
Klebsiella	1,99% (10 <sup>2</sup> -10 <sup>3</sup> )	2,87% (10 <sup>2</sup> -10 <sup>3</sup> ) (10 <sup>2</sup> 10 <sup>5</sup> )	not detected
Str. Pneumonia	3,1% (10 <sup>3</sup> -10 <sup>4</sup> )	3,45 (10 <sup>2</sup> -10 <sup>3</sup> )	not detected

## CONCLUSION

An important role in the development of dysbiosis and inflammation in the oral cavity belongs to the adhesion of microorganisms to the surface of the removable denture structure, due to the physicochemical properties of the structural materials from which it is made. Therefore, for many years, the interest of researchers in new acrylic polymers is understandable. Despite certain disadvantages, these polymers are economically profitable, highly technological and with good physical and mechanical properties. A comparative study of the clinical effectiveness of the domestic hot-setting acrylic base polymer "Belacryl-EGO" with the well-known analogue "Ftorax" showed good results in assessing the total area of the inflammatory process of the tissues of the prosthetic bed. In VSMU named after N.N. Burdenko, at the department of propeudeutic dentistry, a comprehensive technique was developed for therapeutic and preventive measures against dysbiotic and inflammatory complications in patients after orthopedic treatment with removable dentures made of acrylic base polymer. The use of the developed adhesive dental gel with a probiotic in combination with the intake of a synbiotic in the form of a lozenge made it possible to achieve the best result of the state of the oral mucosa in a short time based on a macrohistochemical and objective examination. It was positively assessed by patients during the adaptation period, which also confirmed its feasibility. Analysis of the results of a microbiological study suggests that a removable denture made of acrylic polymer "Belacryl-EGO", in combination with the complex use of probiotic and synbiotic, is a more effective orthopedic treatment, compared with the results obtained in the study of this indicator in patients with removable dentures made of acrylic polymers "Ftorax" and "Belacryl-EGO".

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