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ABSTRACT

of the dissertation for the degree of Doctor of Philosophy

RATIONAL USE OF ACRYLIC PLASTICS IN REMOVABLE DENTAL PROSTHETICS

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GENERAL CHARACTERISTICS OF THE RESEARCH

Relevance of the topic. Over recent years, the biocompatibility of the materials used has become an urgent problem in modern stomatology, since it is closely related to the quality of dental prosthetics for the population. The growth of chronic diseases of various organs and systems of the organism in recent decades and their spread among the representatives of the elderly and senile age population make it very important to solve the problem associated with the diagnosis and prevention of complications of prosthetics and intolerance to basic prosthetic acrylic materials[1,2,3,4,5].

When worn for a long time, these materials can be released into the oral cavity environment in the form of various chemical compounds, which, under favorable conditions, due to their direct contact with the mucous membrane of the oral cavity or prosthetic bed, can cause side effects of a toxic-allergic nature.

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The presence of the base of the removable prosthesis in the oral cavity is the main factor causing the development of the pathological process in the soft and hard tissues of the prosthetic bed. The cause of the onset and further development of inflammation of the tissues of the prosthetic bed is the accumulation of representatives of opportunistic and pathogenic microflora and other reasons.

And the actual issue of modern dentistry is the development and improvement of the used basic and auxiliary materials.

Allergic diseases and their complications, the number of which is constantly growing, occupy a special place in the structure of pathology of an infectious and non-infectious nature [6,7,]

With removable dental prosthetics, the main pathogenetic risk factors for the developpment of the above problems can be both traditional old materials and materials developed in the course of the development of dental materials science for the manufacture of dental plate structures, and some chemicals in their composition become immunosuppressive and can cause allergic reactions [8,9,10].

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Therefore, one of the new and demanded areas of modern dental science is the clinical and laboratory study of the effect of basic materials on the state of the oral cavity organs.

Despite the development of materials science and the therapeutic and prophylactic measures taken, the number of patients who are dissatisfied with the quality of the manufacture of removable dentures, and the number of complications from their negative impact, does not decrease.

The improvement of the basic materials and manufacturing technology of the structures themselves does not completely solve the problem of removable dentures, and therefore the cause of the shortcomings and complications must be considered in complex physiological processes of the relationship of dentures with the tissues surrounding the prosthesis and other organs of the oral cavity, and the whole organism in the whole.

Since, some materials used in orthopedic stomatology, in particular, removable dentures, cause a pronounced negative reaction of the prosthetic bed tissues, the optimal choice of material for making a denture should be carried out with the determination of specific immunoglobulins in the blood and taking into account the individual characteristics of the immune system of patients [11.12]

However, to date, this problem is still relevant in the development of scientifically based recommendations for orthopedic patients, especially, of the elderly and senile age.

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Object of the research. The study involved groups of 160 and 155 patients who attended the Dental Clinic of AMU and district and rural polyclinics for repeated dental prosthetics.

The adaptive capacity of the tissues of the oral cavity after the orthopedic treatment was assessed in 140 patients with prostheses on both the upper and lower jaws based on the analysis of complaints, examination results, and laboratory parameters of mixed saliva.

Forty-eight common rabbits weighing in the range of 2.0-2.9 kg and aged 1-2 years were used. The test animals were divided into 4 different groups of 12 rabbits in each group.

The purpose of the research was to assess the degree of the toxic effect of various basic acrylic materials used in orthopedic stomatology and to propose optimal materials taking into account the anatomical and physiological characteristics of the oral cavity, age, and other indicators.

Research objectives:

1. Based on clinical studies, to establish the range and level of providing stomatological orthopedic care to patients.
2. To reveal histomorphological changes in the surrounding soft tissues after the introduction of a microplate made of various groups of acrylates.
3. To study the effect of various basic materials on the biochemical parameters of the oral cavity by the amount of enzymes in mixed saliva.
4. To study in a comparative aspect the microflora of the oral cavity when wearing prostheses from various base plastics.
5. To determine in a comparative aspect the clinical results of orthopedic treatment of patients with removable dentures made of various acrylic plastics.
6. Based on the results obtained, to develop an algorithm for the treatment and subsequent rehabilitation of prosthesis-wearing patients in elderly and senile age groups.

7. To develop recommendations for reducing the degree of side effects of basic polymeric materials on the organism of prosthesis wearers.

Research methods: The research methods included the following parameters:

- measuring the rate of salivation
- pH measurement of saliva
- microbiological and biochemical examination of saliva
- morpho-histological examination of tissues of experimental rabbits
- clinical examination of patients, also using the OHIP-14 questionnaire
- statistical processing of the received data

The main provisions submitted to the defense of the dissertation:

- the functional state of the organs and tissues of the oral cavity in removable dental prosthetics depends on the type of acrylic plastic.
- acrylic bases, prepared by the methods of polymerization, are distinguished by a high degree of contamination by representatives of the pathogenic oral microflora.
- the base material with a low level of residual monomer content practically does not have a negative effect on the structural components of the oral cavity of the patients wearing prostheses.
- the choice of basic materials for the manufacture of removable prosthetic structures should be performed considering the histomorphological changes in the surrounding tissues after the biomaterial implantation.

Scientific novelty of the research:

- the toxic effect of various groups of dental base materials was studied experimentally in a comparative aspect. The data obtained confirmed by histological studies.

- according to the indicators of clinical, laboratory, and histomorphological studies, the degree of neutrality in relation to the surrounding tissues of the base prosthetic materials used in the work was assessed.

Practical significance.

1. Based on clinical studies, the spectrum and level of providing dental orthopedic care to patients have been established.
2. The tactics of a dentist are proposed for the optimal choice of acrylic base plastics, which are less toxic, in providing orthopedic dental care to elderly and senile persons.

Approbation. The main points of the dissertation were reported and discussed at: a scientific congress dedicated to the 90th anniversary of the Azerbaijan Medical University and the 80th anniversary of higher pharmaceutical education in Azerbaijan "Modern problems of pharmacy" (Baku-2021), as well as at a scientific conference called "Theoretical and applied issues of science and education", Tambov, 2020.

The main aspects of the research are set out at an expanded meeting of the Department of Orthopedic Dentistry with the participation of employees of other specialized dental departments of the Azerbaijan Medical University (17.10.2018, protocol № 16), discussed at the scientific seminar of the Dissertation Council ED 2.05 operating at Azerbaijan Medical University (18.06.2021, protocol № 10).

Implementation of research results. The results of this study introduced into the practice of the dental clinic of AMU, as well as into the educational process at the department of prosthodontics dentistry.

The name of the organization where the dissertation has been accomplished. The research work was carried out at the department of prosthodontics dentistry of the Azerbaijan Medical University, on the basis of the Dental Clinic and SRC of AMU.

Published works. Based on the results of the dissertation, 19 scientific works were published, 14 of which are articles and 5 are theses, including 3 articles and 3 theses in foreign publishing houses.

Volume and structure of the dissertation. The dissertation is presented on 163 pages of computer text (167151 characters) and consists of an introduction (6068 characters), a literature review (49647 characters), a description of the materials and methods of the research (12513 characters), chapters of the results of our own research and their discussion (74142 characters), results, conclusions and practical recommendations (24,781 symbols), a list of scientific literature (20 pages) containing 188 sources, both domestic and foreign scientists. The dissertation includes 30 tables, 28 charts.

MATERIALS AND METHODS OF THE RESEARCH

At the first stage of the work, groups of 160 and 155 patients were formed, who attended the Dental Clinic of the AMU, district, and rural polyclinics for repeated dental prosthetics. In our studies, we used removable dentures manufactured from base materials made of acrylic plastics. When studying the reasons for repeated prosthetics, subjective reasons, complications, and disadvantages of prosthetics were revealed. The adaptive capacity of the oral cavity tissue after the orthopedic treatment was assessed in 140 patients with prostheses on the upper, and lower jaws based on the analysis of the complaints, the results of examinations, and laboratory parameters of mixed saliva (10, 15 days, 1 and 2 months after orthopedic treatment). The collection of mixed saliva was carried out by spitting into a glass tube for 5 minutes (the rate of secretion and pH of saliva were determined).

Microbiological studies were carried out in relation to two groups of oral microorganisms: the resident group, which plays a stabilizing role in the microbiocenosis of the oral cavity, and the pathogenic group, which has virulence factors and can support the development of various inflammatory processes in the oral cavity

(Candida albicans). To study the qualitative and quantitative composition of the microflora of the oral cavity, the following nutrient media were used: 5% blood agar to determine the total level of microbial contamination of the oral cavity, yolk-salt agar, sugar broth, Sabouraud medium, and "Mitis Salivarius Agar". The collected samples were immediately placed in Stuart Transport Medium and sent to the research laboratory for further study. The study of the quality of life, which in international medical practice is considered to be a very informative and reasonable method for assessing the health of patients, was carried out to assess the degree of influence of the performed removable prosthetics and supportive conservative therapy. A specialized questionnaire was used to determine the Oral Health Impact Profile (OHIP-14, Slade G.D. (1997)), which contains 14 questions reflecting the impact of removable prosthetics on the daily life of patients.

According to the purpose of the research, the studied acrylic materials were experimentally introduced into the femoral region in the subcutaneous tissues of common rabbits, and the biomaterials taken were subjected to histological examinations to assess changes in the surrounding tissues for 4 weeks. Common rabbits (48 animals), weighing in the range of 2,0-2,9 kg and aged 1-2 years were used in the experiments. After local anesthesia with 1% novocaine solution, the subcutaneous tissue was opened with a small incision, where plates from previously prepared acrylic dentures measuring 0.5x1.0x2.0 cm were fixed, after which the section of the dissected skin was removed with a surgical suture. The experimental animals were observed for 28 days from the beginning of the experiment. During the experiment, the test animals were divided into 4 different groups of 12 rabbits in each group. During the study, in 3 rabbits from each group, at the end of the first, second, third, and fourth weeks under local anesthesia, skin areas with the material injected previously and subcutaneous tissues were cut out. The primary surgical debridement of the wound was carried out.

After the created experimental model, the test animals were divided into 4 groups of 12 rabbits in each: Group I (control) - consisted of 12 rabbits on which colorless plastic was used; Group II (control) - consisted of 12 rabbits on which “Ftorax” was used; Group III (comparison group) - consisted of 12 rabbits on which “Meliodent HC” was used; Group IV (main) - consisted of 12 rabbits on which "Belacril" was used. During 4 weeks of the research, the skin and subcutaneous tissue areas were fixed in a 10% formalin solution for a day, after which the samples were taken for a macroscopic examination.

The effectiveness of preventive measures at various stages after the treatment was assessed based on the analysis of anamnestic data, complaints, examination results, bacteriological data, and biochemical parameters of mixed saliva. In total, 46 patients divided into three groups (17 people in the main group; 15 in the comparison group with signs of inflammatory changes in the prosthetic bed, and 14 in the control group without signs of mucosal inflammation) were examined.

Orthopedic treatment in the main group was carried out with the use of a decoction of the leaves of the medicinal sage as an astringent and anti-inflammatory agent, with a simultaneous effect on the mucous membrane of the prosthetic bed in the form of applications of the drug "Metragil Denta" 3 times a day for 10-14 days; In the control group, a decoction of the leaves of medicinal sage was applied for prophylactic purposes; in the group of comparison, following the recommended treatment standards, rinsing with oral antiseptics (0.05% solution of chlorhexidine digluconate) was recommended. Besides, in the above groups of orthopedic patients, the volume, rate, and pH of secreted saliva were determined. In general, a laboratory study of 46 samples of biological material was conducted.

The research results were processed by the method of variation statistics. To characterize a group of homogeneous units, their arithmetic mean values (M), standard error (m), and the range

of changes (min-max) were determined. For statistical data processing, the nonparametric U test (Wilcoxon-Mann-Whitney) and the parametric Student's t-test were used as a method for assessing the differences in indicators. The statistical difference between the groups was considered significant at $p < 0,05$. Statistical processing of the obtained data was carried out on a personal computer using modern software and the Statistica 7.0 application package.

RESEARCH RESULTS AND DISCUSSION

Analysis of the structure of objective and subjective reasons for the repeated appeal of patients regarding replacement of old prostheses showed that in Baku, the main reason for replacement of prostheses was aesthetic disorders (48,8±3,95%) and the subjective desire of the prosthesis wearers themselves (45,0±3,93%), which were most often associated with the desire to replace the existing structures with more modern ones (Table 1).

The minimal reasons for repeated prosthetics in this group were a pain in the area of the prosthesis base and plaque formation on the surface of the removable structure (for both factors – 15,0±2,82%).

Fracture of the prosthetic plate, requiring immediate replacement, was noted in 29,4±3,60% of cases. The third most frequent reason for repeated prosthetics among patients who attended the city dental clinic was a poor fixation of the prosthesis, the main cause of which was atrophy of the alveolar ridge of the upper and lower jaws (33,1±3,72%).

Thus, in the city, the most frequent reasons that prompted patients to seek orthopedic care again were subjective reasons. The clinical studies revealed that during the first ten days, only a small number of orthopedic patients got used to removable dentures, moreover, those with removable dentures fixed on the upper jaw were more often accustomed to them – 12,7±3,95%.

Table 1.

The structure of the reasons for repeated prosthetics in the examined persons

Reason	City		Rural districts		Total	
	Abs	%	Abs	%	Abs	%
Breakage of the prosthesis	47	29,4± 3,60	72	46,5± 4,01	119	37,8± 2,73
Presence of dental plaque on the prosthesis	24	15,0± 2,82	38	24,5± 3,46	62	19,7± 2,24
Inflammation of the prosthetic bed tissues	26	16,3± 2,92	32	20,6± 3,25	58	18,4± 2,18
Aesthetic disorders	78	48,8± 3,95	57	36,8± 3,87	135	42,9± 2,79
Need for prostheses	39	24,.4± 3,39	35	22,6± 3,36	74	23,5± 2,39
Pain in the prosthesis area	24	15,0± 2,82	17	11,0± 2,51	41	13,0± 1,90
Subjective desire of the patient	72	45,0± 3,93	12	7,7± 2,15	84	26,7± 2,49
Poor fixation of the prosthesis	53	33,1± 3,72	64	41,3± 3,95	117	37,1± 2,72
Total	160	100	155	100	315	100

By the end of the first month, 12,7±3,95% of the patients were accustomed to wearing a prosthesis on the upper jaw, while with adaptation to structures fixed on the lower jaw, the situation was less favorable. Only 10,1±3,20% of prosthesis wearers were accustomed to wearing a prosthesis on the lower jaw within the aforementioned terms.

By the end of the studies, the number of adapted patients in both compared groups increased. The level of adaptive capabilities of the organism significantly increased, and the number of patients accustomed to wearing a prosthesis on the lower jaw increased and on the 60th day of the observation, it amounted to 21,3±4,34%. By the end of the second month, another 15,5±4,29% of the patients got used to removable structures on the upper jaw. The majority of patients who never got used to the prosthesis were diagnosed with impaired diction, tactile sensitivity, and pathological changes of an inflammatory nature on the mucous membrane of the prosthetic bed (chart 1).

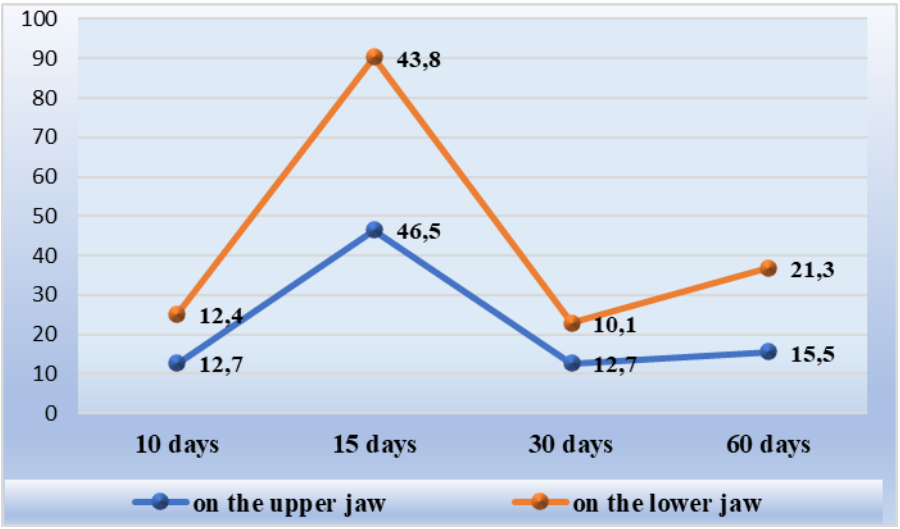

Chart 1. Time of adaptation to removable dentures

In the course of our studies, the level of prevalence and intensity of various general somatic pathologies was assessed, i.e. the general state of the organisms of orthopedic patients who applied for removable dentures and had been using acrylic structures for a long time (table 4).

The detection of common diseases is important, because, having a negative effect on various organs and systems of the organism of prosthesis wearers, in particular on immunological reactivity, they can serve as a predisposing pathogenetic factor for the development of certain complications in the process of wearing orthopedic structures made of acrylic plastics.

In a statistical analysis of the results obtained after the installation of prostheses, as well as anamnestic data in all examined patients, general pathologies affecting the organs of the cardiovascular, endocrine systems, and gastrointestinal tract were previously diagnosed (table 2).

Table 2.

Assessment of the general state of health of the examined orthopedic patients (n=315)

The character of the pathology of internal organs	Number of patients	
	Abs.	%
Patients with nervous diseases	6	1,9±0,77
Practically healthy patient	41	13,0±1,90
Patient with GUS diseases	38	12,1±1,84
Patient with CVS diseases	119	37,8±2,73
Patients with chronic gastrointestinal diseases	49	15,6±2,04
Patients with diseases of the respiratory system	44	14,0±1,95
Patients with Endocrine Diseases	18	5,7±1,31

A comparative analysis of the incidence of certain diseases revealed that the most frequent among prosthesis wearers with experience in using prosthetic structures were pathologies of the cardiovascular system (CVS) – 37,8±2,73%; the minimum indicators were recorded for diseases of the nervous and endocrine systems – 1,9±0,77% and 5,7±1,31%, respectively. Chronic diseases in medical history occurred in 26,7% of cases.

Pathologies of organs and tissues of the respiratory system were the background for 14,0±1,95% of patients and the results were almost similar in terms of the complication frequency of gastrointestinal tract diseases, on average 15,6±2,04%.

A total of 13,0±1,90% of persons matched the group of orthopedic patients without any general somatic diseases.

The analysis of the bacteriological research data presented in the following table revealed a high level of microbial contamination of the oral mucosa of patients, both for the first time prosthetics and those who use removable acrylic structures for many years, compared to the control group, which consisted of practically healthy persons without dentures (table 3).

Table 3.

Oral cavity microflora in prosthesis wearers

Microflora	Control group (n =8)		Main group (n =11)		Comparison group (n =9)	
	Abs.	%	Abs.	%	Abs.	%
Streptococcus haemolyticus	3	37,5±17,1	8	72,7±13,4	7	77,8±18,9
Staphylococcus aureus	1	12,5±11,7	2	18,2±11,6	2	18,2±11,6
Enterococcus spp.	0	0	2	18,2±11,6	1	11,1±10,5
Lactobacillus spp.	4	50,0±17,7	2	18,2±11,6	2	18,2±11,6
Candida albicans	1	11,1±10,5	6	54,5±15,0	8	88,9±10,5

A comparative assessment of the indicators of oral microbiocenosis in first-time prosthetics and orthopedic patients with many years of experience revealed significant differences in the frequency of contamination with enterococci and fungi of the Candida genus, which, colonizing the inner surface of removable

plate prostheses and the mucous membrane of the prosthetic bed, contribute to the occurrence of so-called prosthetic stomatitis and further chronicity of the inflammatory process.

The sampling of material for laboratory studies was carried out in three groups: the 1st group (control group) consisted of 8 practically healthy persons who did not use any prosthetic structures; the 2nd main group (11 patients) included patients who received prosthetics for the first time, and the comparison group (3rd group) included 9 orthopedic patients who used removable prosthetic structures for a long time (table 4).

An unfavorable factor, often contributing to the emergence and development of prosthetic stomatitis, was some aggressive types of fungal infections frequently detected in oral fluids of prosthesis wearers of both groups, in the first-time prosthetics and in persons with many years of experience in wearing acrylic-based plates.

Table 4.

Structural changes in the oral fluid of orthopedic patients (M ± m)

Studied indicators	Control group (n = 8)	Patients	
		Main group (n=11)	Comparison group (n=9)
Salivation rate (ml/min)	0,71 ± 0,016	0,41 ± 0,013 $P_1 < 0,001$	0,42 ± 0,019 $P_1 < 0,001$ $P_2 > 0,05$
Oral fluid pH	6,90 ± 0,077	6,75 ± 0,030 $P_1 > 0,05$	6,84 ± 0,052 $P_1 > 0,05$ $P_2 > 0,05$

Some differences were found in the homeostasis indicators of the oral cavity in prosthesis wearers compared to persons in the control group who did not use removable dentures. In this case, the oral fluid pH turned out to be higher in prosthesis wearers with many

years of experience of using prosthetic structures – 6,84±0,052, compared to the main group of patients.

The maximum values for the studied factor, which characterize the oxidation-reduction potential of the mixed saliva, were registered in the control group.

All complete removable dentures used by the examined patients were made at different times from acrylic plastics following the traditional technique. This research allowed us to establish the frequency of complications, the causes of intolerance in the short and long term.

In addition to the passport data, the type of the prosthesis, the time of manufacture of the prosthesis and the duration of wearing, if it is primary prosthetics or re-prosthetics, terms of adaptation, the presence of side effects, the number of re-prosthetics were included in the questionnaire for the surveyed. In total, 315 patients were under our supervision. Their comprehensive dental examination was carried out. The rest, for whom various designs of dentures had been previously made and who needed the re-manufacture or replacement of old dentures, were included in the control group.

Patients underwent questioning and dental examination to assess the hygienic state of removable dentures at various times of their use. In the course of orthopedic dental treatment, patients of the main group underwent a set of preventive measures, in particular, training in oral hygiene and the rules of hygienic care of prosthesis designs, individual selection of therapeutic and prophylactic agents. Dental re-examinations were performed in all patients of the main group immediately after prosthetics and 14 days after the end of the orthopedic one. Using the Oral Health Impact Profile OHIP-14 questionnaire, the quality of life was determined in 35 patients using prostheses in different age groups.

The study of the quality of life, which in international medical practice is considered to be a very informative and well-founded method for assessing the health of patients, was carried out to assess the degree of influence of removable dental prostheses and maintenance/conservative therapy. A specialized questionnaire was

used to determine Oral Health Impact Profile (OHIP-14, Slade GD (1997)), which contains 14 questions reflecting the impact of removable prosthetics on the daily life of patients.

According to the results of the analysis of the data of clinical and epidemiological studies, one of the important factors influencing the effectiveness of removable dentures and the quality of life of orthopedic patients using such structures turned out to be the age indicator.

For an accurate assessment of the quality of life of the examined orthopedic patients in all age and sex groups, an extensive comparative analysis of the data obtained using a specialized questionnaire envisaged for dental patients was carried out (table 5).

Table 5.

Indicators of the quality of life depending on age, %

Age (in years)	Good level of LQ	Satisfactory level of LQ	Unsatisfactory level of LQ	Poor level of LQ
38-43 (n=12)	2 (16,7±10,8)	4 (33,3±13,6)	4 (33,3±13,6)	2 (16,7±10,8)
44-50 (n=13)	2 (15,4±10,0)	4 (30,8±12,8)	4 (30,8±12,8)	3 (23,1±11,7)
51 and older (n=10)	2 (20,0±12,7)	2 (20,0±12,7)	4 (40,0±15,5)	2 (20,0±12,7)
Total (n=35)	6 (17,1±6,4)	10 (28,6±7,6)	12 (34,3±8.0)	7 (20,0±6,8)

Thus, as indicated above, the number of individuals with poor quality of life in the age group of 44-50 years and 51 years and older was on average 23,1±11,7% and 20,0±12,7%, respectively, contrary to the majority of respondents in the first age group, where only 16,7±10,8% of life quality cases were marked as negative.

Besides, the total number of orthopedic patients who were completely dissatisfied with the quality of life was almost similar to

the indicators for a good level, except for the second age group, where the obtained values were almost 1.5 times higher.

The clinical condition and characteristics of the microflora of the oral mucosa were assessed in 43 patients at the age of 25 to 67 years with removable dentures on the upper and lower jaws. For a comparative analysis, bacteriological studies of the microbial colonization features of the mucous membrane of the prosthetic bed were carried out in three groups of prosthesis wearers. “MeliodentHC” - 15 persons; the other type of base material was a PMMA-based hot polymerization plastic belonging to graft copolymers based on acrylic resins with cross-linked polymer chains "Vertex Rapid Simplified" - 13 patients. In the examined orthopedic patients of the third group, the microbial colonization characteristics of the mucous membrane of the prosthetic bed were studied when wearing removable plate prostheses made of “Ftorax”, which belongs to graft copolymers based on acrylic resins.

Microbiological studies were carried out in relation to representatives of the normal stabilizing microflora of the oral cavity (*S.sanguis, S.salivarius, P.anaerobius, E.faecialis, Prevotella oralis)* and the pathogenic group of bacteria responsible for the onset and development of the inflammatory process in the soft and hard tissues of the oral cavity (*actinomycetes, Prevotella gingivalis, Fusobacterium spp. Candida albicans*). The material was taken at a certain time after the installation of prostheses - on the 5th and 10th days, as well as after 1 month. The study of the microbiocenosis of the oral cavity was carried out using aerobic and anaerobic cultivation techniques at a temperature of 37°C. To assess the degree of colonization of the mucous membrane of the prosthetic bed and the basis of the prosthetic structure, the content of the studied bacteria was determined per 1 cm^2 of the adhesive film (log CFU / cm^2). In the course of the clinical and laboratory studies of prosthetics of patients for the manufacture of removable plate structures, materials from acrylics were used with the hot polymerization method, in particular, "Vertex Rapid Simplified", the

powder of which is a fine, suspension copolymer of methacrylic acid methyl ester and a liquid part, represented by methyl ester of methacrylic acid. At the first stage of the research, the frequency of contamination and primary adhesion of microorganisms were determined to develop diagnostic criteria and predict the development of dysbiosis, the increase of the risk of stomatitis against the background of increased colonization of soft tissues of the oral cavity of prosthetic wearers by representatives of opportunistic pathogens and pathogenic microbial flora, the degree of their adhesion in the process of wearing prostheses. Statistical analysis of the obtained laboratory data revealed certain disorders in the microbiocenosis of the oral cavity of the examined patients already on the 10th day after the completion of orthopedic treatment. During the research, significant differences were found in the level of colonization of the mucous membrane by some representatives of virulent and stabilizing types of microorganisms.

The data obtained show that the most important stabilizing and virulent types of microbial flora have the ability to colonize the soft tissues of the oral cavity of prosthesis wearers to varying degrees, depending on the characteristic features of the base material. Besides, the quantitative and qualitative parameters of colonization of pathogenic flora in the first and second groups of orthopedic patients using structures based on “Ftorax” and “Vertex Rapid Simplified” significantly exceed those for the same types of microorganisms in the third group of patients.

To establish changes in the microbiocenosis of one of the main biotopes of the mouth, both prosthesis wearers without the presence of inflammatory changes on the mucous membrane of the prosthetic bed, and those having them in the form of hyperemia and edema were selected. Further identification of bacteria was carried out according to biochemical properties using test systems. Forty-six patients, divided into three groups (17 persons in the main group; 15 in the comparison group with signs of inflammatory changes in the

prosthetic bed and 14 in the control group without signs of mucosal inflammation) were examined (table 6).

Microbiological examination of the microflora state of the oral mucosa was carried out before and, on the 7th, and 60th days of using removable acrylic prosthetic structures in patients of the control and main groups, as well as the comparison group.

Table 6.

The state of the oral cavity microflora before and after prosthetics with removable dental structures

Treatment period	Patients with removable dentures					
	Group 1 control (n=14)		Group 2 comparison (n=15)		Group 3 main (n=17)	
	Abs	%	Abs	%	Abs	%
S. salivarius (excretions %)						
Before treatment	6	42,9± 13,2	4	26,7± 11,4	6	35,3± 11,6
After 1 week	5	35,7± 12,8	7	46,7± 12,9	9	52,9± 12,1
After 2 months	7	50,0± 13,4	6	40,0+ 12,7	12	70,6± 11,0
S. epidermidis (excretions %)						
Before treatment	5	35,7± 12,8	8	53,3± 12,9	11	64,7± 11,6
After 1 weak	4	28,6± 12,1	7	46,7± 12,9	10	58,8± 11,9
After 2 months	4	28,6± 12,1	6	40,0± 12,7	9	52,9± 12,1
S. aureus (excretions %)						
Before treatment	0	0	2	13,3± 8,8	3	17,6± 9,2

Table 6 (continued)

After 1 week	1	7,1± 6,9	2	13,3± 8,8	3	17,6± 9,2
After 2 months	0	0	2	13,3± 8,8	0	0
Enterococcus spp. (excretions %)						
Before treatment	0	0	0	0	0	0
After 1 week	0	0	1	6,7± 6,4	2	11,8± 7,8
After 2 months	0	0	1	6,7± 6,4	2	11,8± 7,8
Lactobacillus spp. (excretions %)						
Before treatment	6	42,9± 13,2	8	53,3± 12,9	3	7,6± 9,2
After 1 week	5	35,7± 12,8	7	46,7± 12,9	10	58,8± 11,9
After 2 months	5	35,7± 12,8	6	40,0+ 12,7	6	35,3± 11,61
C. albicans (excretions %)						
Before treatment	1	7,1± 6,9	1	6,7± 6,4	3	17,6± 9,2
After 1 week	1	7,1± 6,9	4	26,7± 11,4	9	52,9± 12,11
After 2 months	1	7,1± 6,9	2	13,3± 8,8	3	7,6± 9,2

Orthopedic treatment in the main group was carried out using a decoction of the leaves of medicinal sage as an astringent and anti-inflammatory agent, with a simultaneous effect of the drug "Metragil Denta" on the mucous membrane of the prosthetic bed 3 times a day for 10-14 days; in the control group, a decoction of medicinal sage leaves was used for prophylactic purposes; in the comparison group,

following the treatment standards, it was recommended to rinse the mouth with antiseptics (0,05% solution of chlorhexidine digluconate).

When analyzing the state of the microbiocenosis of the oral cavity of prosthesis wearers, significant differences were revealed in the qualitative and quantitative indicators of various microorganism groups in all examined patients. Significant changes were recorded in the contamination frequency of representatives of both normal resident microflora and opportunistic pathogens and pathogenic bacteria: streptococci, lactobacilli, and fungal infection.

Thus, streptococci were isolated from the oral mucosa of 42,9±13,2% of orthopedic patients of the first group before the prosthetics, regarding other microorganisms, in patients of the same group, lactobacilli were found in 35,7±12,8% of the patients and pathogenic staphylococci, i.e. S.aureus, were not detected at all in patients of this group before the prosthetics. In the comparison group, the abundance indicators of pathogenic microorganisms in the same period were significantly higher.

Established as a result of clinical and laboratory studies, more intensive rates of decline in dental health in prosthesis wearers with pathological changes in the soft tissues of the oral cavity surrounding the base of the prosthetic structure indicate that risk factors for oral health, often accompanying the process of wearing acrylic prostheses, have a pronounced negative effect on the general condition of the patient, contributing to a decrease in the adaptive capabilities of the organism and a deterioration in the quality of life.

In orthopedic patients of the main group, fungi of the genus *Candida* (52,9±12,11%) were recorded comparatively more often than in other examined groups of prosthesis wearers for the same periods. However, it is very important to note that their number in the same group sharply decreased by the end of observations, i.e., at the final stage of microbiological studies, and amounted to 7,6±9,2%. An increase in the frequency of occurrence and the number of Enterococcus spp. was registered.

Thus, the identification of the species composition of the oral cavity microflora at different stages of prosthetics and the complex supportive therapy will allow timely implementation of prophylactic measures and adequate antimicrobial therapy, taking into account the microbial nature and sensitivity to various drugs.

Besides, in the above groups of orthopedic patients, the volume and the rate of saliva secretion, and the pH of saliva were determined. In total, a laboratory study was carried out on 46 samples of biological material.

The effectiveness of orthopedic treatment and preventive measures at various stages after the treatment was assessed based on the analysis of anamnestic data, complaints, examination results, bacteriological data, and biochemical parameters of mixed saliva. Collection of biological material was carried out 5 minutes before, then 1 week and 2 months after orthopedic treatment.

Analysis of the rate of salivation and the state of acid-base balance of the activity of hydrogen ions in the oral fluid of prosthesis wearers revealed a significant decrease in these indicators in the process of wearing acrylic structures and before the therapeutic and prophylactic measures. Probably, the presence of an inflammatory process on the mucous membrane of the prosthetic bed to a certain extent contributes to the depletion of the adaptive capabilities of the oral cavity, which is reflected in the rate of background salivation and activity, associated with the ecological balance of hydrogen ions (pH) in the oral cavity.

According to pH values of saliva in the examined orthopedic patients, at the initial stage of the research, the activity of hydrogen ions shifted to the relatively acidic direction in all three groups – 6,67±0,016 and 6,70±0,020, in the control and main groups, respectively (table 7).

We studied the effect of acrylic plastic materials of various compositions used in dental prosthetics on soft tissues. According to the goal of the study, the considered acrylic plastic materials of various compositions were experimentally introduced into the

subcutaneous tissues of common rabbits and, using a histological study, the changes that occurred in the tissues surrounding these materials were examined during 4 weeks (28 days) of the study.

Table 7.

Indicators of the functional activity of the salivary glands in prosthesis wearers

Indicators	Control group (n = 14)	Comparison group (n = 15)	Main group (n = 17)
Salivation rate (ml / min)			
Initial level	0,71±0,012	0,53±0,019 ***	0,47±0,015 ***
After 2 months	0,71±0,012 P < 0,01	0,69±0,013 P < 0,001	0,63±0,011*** P < 0,001
pH of saliva			
Initial level	6,67 ± 0,016	6,73 ± 0,013	6,70±0,020
After 2 months	6,75 ± 0,020 P < 0.05	6,77 ± 0,017* P > 0,05	6,76±0,024** P > 0,05

Note: significance of differences: * - p <0,05; ** - p <0,01;
*** - p <0,001 - compared to the indicator of the control group;
P - in relation to the initial value.

In our research, 48 common rabbits were used with a weight in the range of 2,0-2,9 kg and an age of 1-2 years. As already noted, an experimental model was formed on all rabbits in order to study the effect of acrylic plastic materials on soft tissues. For the experiment, the femoral region of rabbits was selected. For this purpose, first of all, 1% novocaine solution was injected into the corresponding area for local anesthesia. The subcutaneous tissues at the site of the experimental model were opened with one incision.

Particles of previously prepared acrylic plastic materials of various compositions with dimensions of 0,5x1x2,0 cm were placed in the subcutaneous areas of the femoral region of animals. Then the incision in the skin was removed with a surgical suture. The

experimental animals were observed for 4 weeks (28 days). According to the different compositions of acrylic plastic materials used in the experiment, the test animals were divided into 4 groups with 12 rabbits in each group.

Throughout the study, on 3 rabbits from each group, at the end of the first, second, third, and fourth weeks, the experimental model was suspended. For this, anesthesia of the corresponding zone was performed again with a 1% solution of novocaine.

Acrylic materials embedded in the subcutaneous areas along with the skin and subcutaneous tissues were removed by excision. Primary surgical debridement of the wound was performed. The purpose of stopping the study in each of the 4 groups at different stages was to assess the effects of the same material on soft tissues at these stages. Euthanasia was not performed during the study; besides, there were no cases of death or exclusion of animals from the study for any other reasons.

After the experimental model creation, the test animals were divided into 4 groups with 12 rabbits in each: Group I - consisted of 12 rabbits on which colorless plastic was used; Group II - “Ftorax” group with 12 rabbits, Group III - “Meliodent HC” group with 12 rabbits; Group IV - "Belacril" group with 12 rabbits.

According to the degree of reliability, depending on the significance, three degrees were determined - weak (<0,05), high (<0,01), and very high (<0,001).

The results of the histological studies were analyzed for each parameter separately. In all biopsy specimens in different groups, changes were found directly in the tissues surrounding the acrylic plastic materials. Changes in tissue areas farther from acrylic-plastic materials were in the minority.

Besides, in the samples of the group where colorless plastic was used, more severe changes were noted, and minimal changes were detected in the group where "Meliodent HC" was used (Figure 1).

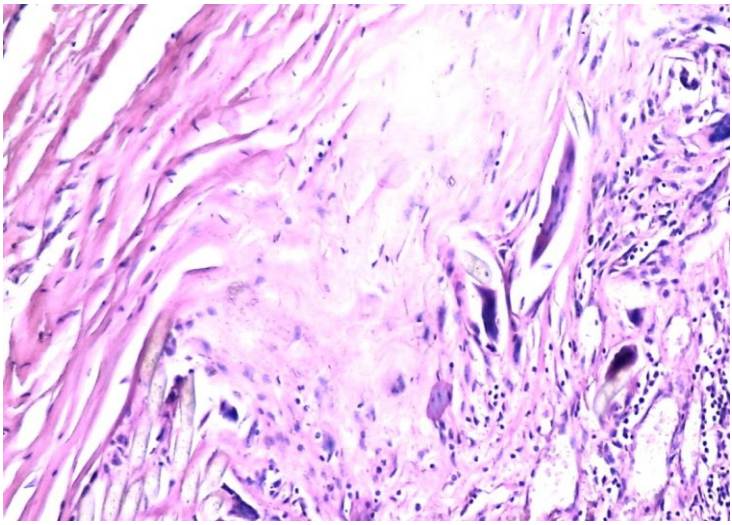

Figure 1. Lymphocytes and multinucleated giant cells with fibrosis in the Meliodent HC group, the fourth week of the study (color: hematoxylin-eosin, magnification: x40).

The dynamic observation did not reveal any regularities in the increase or decrease in the number of giant multinucleated cells. In most samples, giant multinucleated cells, along with histiocytes and lymphocytes, formed aggregates - formations of granulomas. Giant multinucleated cells and granuloma formations were most noted in the Meliodent HC group (Figure 1).

The group with the smallest changes of this kind was the second, where Ftorax was used. Observations showed that infiltration with histiocytes, as well as the formation of giant multinucleated cells and granulomas, occurred in the form of a nonspecific reaction, regardless of the type of acrylic materials.

These changes occur only due to the presence of foreign objects in the tissues. The rate of occurrence of giant multinucleated

cells and granulomas throughout the study in different groups is shown in table 8.

Table 8.

The intensity of the appearance of giant multinucleated cells and granulomas in different groups at different weeks of the study

Groups / Weeks	I	II	III	IV
1	1,00±0,00	0,66±0,57	1,66±0,57	0,66±0,57
2	1,33±0,57	0,33±0,57	2,00±1,73	1,00±0,00
3	1,33±0,57	0,66±0,57	1,66±1,15	1,66±1,52
4	1,00±0,00	1,00±0,00	2,33±0,57	1,00±1,73

I – colorless plastic group;
II – "Ftorax" group;
III – "Meliodent HC" group;
IV – "Belacril" group.

Similar to neutrophil infiltration, which characterizes acute inflammation, necrotic changes characteristic of acute tissue damage were observed sporadically in only a few samples. In the Meliodent HC group, without exception, none of the samples showed necrosis. In the remaining groups, only one sample of each group had foci of focal necrosis.

CONCLUSIONS

1. After primary prosthetics in regional and rural dental institutions, the two most rare reasons for patients seeking repeated orthopedic treatment were the subjective desire of the patient – 7,7±2,15% and pain in the area of the prosthetic bed – 11,0±2,51%, respectively [3,6];
2. A comparative assessment of the indicators of oral

microbiocenosis in first-time prosthetics and orthopedic patients with many years of experience revealed significant differences in the frequency of contamination with enterococci and fungi of the genus Candida [8,17];

3. In the group of prosthesis wearers who were not diagnosed with pathological changes in the mucous membrane of the oral cavity, the data of the questionnaire on the quality of life were even lower and amounted within – 2,38±0,053 points [4,9];
4. Bacteroids *Prev. Oralis* were distinguished by a rather high "compatibility" with the studied acrylic plastic of hot polymerization, the contamination rate of which sharply increased already on the 10th day and amounted to approximately – 4,00±0,076 lgCFU / cm^2 [8,18];
5. In the “Ftorax” patients, the rate of mixed saliva formation is more pronouncedly reduced, there is a shift in pH towards the acidic side [1,2,14];
6. According to the results of the study, acrylic plastic materials of different compositions affect soft tissue in different ways. So, "Ftorax" most of all irritating and mechanically affecting soft tissues caused the greatest morphological changes [7,12];
7. Despite the absence of a statistically significant difference between the "Meliodent HC" and "Belacril" groups, some histological parameters (sclerosis in the walls of vessels, blood circulatory disorders, etc.) were more intensive in the "Belacril" group [10].

PRACTICAL RECOMMENDATIONS

1. Assessment of the degree of microbial adhesion of the mucous membrane in the prosthetic bed allowed us to draw a conclusion about the pronounced dependence of the oral microflora destabilization and the increased risk of developing inflammatory processes in the oral cavity on the base material.

2. When assessing the basic materials widely used in stomatology and based on the results of microbiological studies, it can be concluded that the level of colonization of the oral mucosa after the prosthetics with "Meliodent" was significantly lower compared to other groups of examined prosthesis wearers.
3. Experimental determination of the degree of pathological changes in the organisms of animals in response to the introduction of samples of various basic materials allows us to predict the occurrence of a side effect of the base material of toxic-allergic genesis and use the most optimal ones.

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