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ABSTRACT

of the dissertation for the degree of Doctor of Philosophy

DYNAMICS OF MICROBIAL ADHESION TO CONSTRUCTION MATERIALS USED IN DENTAL PROSTHESIS

Specialty: 3202.01 - Epidemiology

Field of science: Medicine

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GENERAL CHARACTERISTICS OF THE RESEARCH

The relevance and the completion degree. The population's demand for orthopedic dental care is very high and is formed from a young age, and it becomes significant in older age groups. Throughout their lives, most people have a need for both the use of new orthopedic constructions and the replacement of failed orthopedic constructions with others. In this regard, a comprehensive study of the level of orthopedic dental service, the nature of the population's preference for one or another type of orthopedic constructions or types of construction materials is of great importance for the purposeful planning of orthopedic dental service[1,2.] However, even after the complete orthopedic rehabilitation of the defects in the tooth rows, there may be a need for repeated orthopedic dental services. One of the main reasons for this is the adhesion of pathogenic microflora to various surfaces of structures. The life activity of microorganisms and their metabolites can cause a shortening of the service life of orthopedic structures, and most importantly, diseases of abutment teeth (caries, pulpitis, periodontitis) and prosthesis bed, including inflammatory diseases of the periodontium[3,4]

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In both cases, orthopedic dental structures are removed for treatment purposes, and new orthopedic structures are subsequently applied in their place.

Research conducted in recent years has shown that the intensity of the quantitative and qualitative adhesion of microorganisms can be influenced not only by the types of orthopedic dental devices but also by the material from which they are made[5,6.]

Besides, there is very little concrete information about the adhesion of microorganisms to certain types of construction material and the possible effect of microorganisms on the service life of the construction[7,8.] In this regard, it is relevant to study the degree of adhesion of microorganisms to the orthopedic construction, and their etiological structure, in a comparative aspect with other biotopes of the dental-jaw system[9,10.]

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The objects of research: 200 patients who applied for orthopedic dental services at the Dental Clinic of AMU were selected. The ages of the patients ranged from 14 to 78. Patients were divided into groups according to their ages: under 20 years, 20-29 years, 30-39 years, 40-49 years, 50-59 years, and over 60 years.

Purpose of the research: In patients needing orthopedic treatment, the effects of orthopedic constructions on adhesion properties such as the colonization and presence of microorganisms in the oral cavity were studied based on various dental parameters.

Tasks of the research:

1. Determining the compositional nature of other orthopedic structures in the oral cavity of patients undergoing orthopedic dental treatment by applying different types of orthopedic structures;
2. Determining the nature of dental diseases occurring in connection with various orthopedic constructions that were previously applied;
3. Studying the features of the adhesion of microorganisms, conducting a comparative analysis of their structure in different biotopes of the dental-jaw system and types of orthopedic devices;
4. Determining the colonization abilities of some species of microorganisms gathered on the surfaces of various orthopedic constructions;
5. Evaluation of the effects of various hygienic means on the colonization ability of the *Lactobacillus* species in the oral fluid samples of patients who applied bridge-like prostheses.

Methods of the Research:

Clinical studies (Schiller-Pisarev test, Fyodorov-Volodkin, Greene - Vermillion, PHP indices) and microbiological studies were conducted to clarify the species composition of microorganisms in biological materials of patients with various orthopedic constructions. Student's t-test was used for preliminary assessment of the difference between variance ranks. Non-parametric criteria - Wilcoxon's

(Manna-Whitney) U-criterion, Pearson's $\chi 2$ - criterion were used in frequency analysis for the validation of the obtained results.

Main points presented to the defense of the dissertation:

- There is a correlation between the degree of need for orthopedic dental care and the occurrence of various dental diseases and ages of the patients;
- The reasons for the avoidance of orthopedic dental treatment measures by the contingent of patients involved in the study are mainly subjective in nature;
- Depending on the materials of various orthopedic constructions, the adhesion ability of various microorganisms in the plaque samples formed on their surfaces is different, and this is also reflected in the occurrence and colonization abilities of the respective microorganisms in the patient groups that we divided by those parameters;
- Various hygienic and periodontal indexes helped to evaluate the effectiveness of individual hygiene combinations offered by us. It was found that the combination of fluorine Parodontax toothpaste with Colgate Total 12 daily toothpaste provides more effective hygienic and periodontal indicators in the case of bridge-like metal-ceramic fixed prostheses.

The scientific novelty of the research:

- The orthopedic stomatological status of the population and the extent of its demand in the orthopedic rehabilitation of tooth rows have been determined,
- The prevalence of various orthopedic constructions in the oral cavities of patients was studied,
- The presence of various microorganism species in biological materials of patients suffering from various dental diseases was studied.

The practical significance of the work:

The study of various parameters of the oral cavity under the influence of various individual hygienic measures in patients to whom we apply fixed prostheses allows us to give the right recommendations in the appropriate direction.

Based on the prospective orthopedic dental examination, the study of the level of need for orthopedic dental treatment in the patient contingent and their attitude to the types and materials of orthopedic constructions are important for carrying out planned treatment measures.

Approbation of the research. The main provisions of the dissertation were presented and discussed at the scientific-practical conference dedicated to the 95th anniversary of the Honored Scientist, Doctor of Medical Sciences, Professor Taghi Alakbar Taghizade, Baku, (2018) and at the VIII International Scientific Conference: General question of world science, Amsterdam (2019).

Dissertation work was discussed at the extended meeting (21.02.2022, protocol No. 7) held at the Department of Epidemiology of the Azerbaijan Medical University and with the participation of employees of other specialty dentistry departments and at the Scientific seminar (23.05.2024, protocol No 1) under the Dissertation Council FD 2.28, in specialty 3202.01 - "Epidemiology".

Practical application of the research results.

The materials of the dissertation are used in the educational process of the Departments of Epidemiology and Orthopedic Dentistry of AMU, and the proposed recommendations are applied in practice.

The name of the institution where the dissertation was carried out. The research was carried out in the Epidemiology laboratory of the Azerbaijan Medical University and in the base of the Educational Dental Clinic of AMU.

Publications: 12 works on the subject of the dissertation have been published. Among them, 6 articles and 2 theses were published in the local press, 3 articles and 1 thesis were published in the foreign press.

The volume and structure of the dissertation. The dissertation is a typewritten text consisting of 145 pages (207422 characters). There are Introduction (7445 characters), Literature review (22510 characters), Materials and Methods (25230 characters), Results of personal research (98048 characters), 4 chapters (40316 characters), Results (11539 characters), Conclusion (1,576

characters), Practical recommendations (758 characters), list of used scientific literature (17 pagess). The bibliography contains 150 local and foreign sources.

MATERIALS AND METHODS OF THE RESEARCH

To study the state of dental status in adults, caries and periodontal inflammatory diseases (PID) according to age and gender parameters, we conducted a dental examination of 200 city residents who applied to the Educational Dental Clinic of AMU during 2013-2018. Examinations were performed with a dental mirror and a probe. In the first stage of the trial, patients were divided into age groups: under 20, 20-29, 30-39, 40-49, 50-59, and above 60. After the appropriate orthopedic constructions were applied to the patients and the oral cavities were fully restored, the patients were conventionally divided into groups of 15, 15, 14, and 13 patients. The first 15 patients from these groups were instructed to brush their teeth only with "Colgate-Total 12" toothpaste every morning and evening for 1 month as individual hygiene measures.

In the second group of 15 patients, they were instructed to brush their teeth with "Colgate-Total 12" in the morning and "Herbarium" toothpaste once in the evening before going to bed as personal hygiene measures for 1 month. In the 3rd research group of 14 patients, they were instructed to brush their teeth once in the morning with "Colgate-Total 12" toothpaste and once in the evening before going to bed with "Parodontax with fluoride" therapeutic toothpaste as personal hygiene measures for 1 month. In the last - 4th group, 13 patients were given individual hygiene measures such as brushing their teeth with "Colgate-Total 12" toothpaste once in the morning and once in the evening, and after brushing their teeth with the respective toothpaste in the evening, once before going to bed, to rinse the oral cavity with mouthwash "Loroben". In the first stage, Lugol's solution was used to determine the Fyodorov-Volodkin index for the above-mentioned age groups.

In the second stage of the study, the Schiller-Pisarev test was

performed on the patients of the respective groups. The Fyodorov-Volodkin test allows you to assess the intensity of the state of dental hygiene. The setting of the test and the evaluation of the results are carried out as follows. Lugol's solution (ready-made, sold in pharmacies) is applied to a certain class of teeth, staining of the entire surface of the dental crown indicates the bad hygienic condition of the tooth rows, which is evaluated with 5 points. Coloring of 2/3 of the surface of the dental crown rates 4 points, 1/2 of the surface - 3 points, and 1/4 of the surface - 2 points. The absence of staining is considered an indicator of the satisfactory condition of the tooth rows, and in this case, it rates 1 point.

To determine the prevalence and intensity of gingival inflammation parameters such as Greene - Vermillion‘s simplified oral hygiene index (OHI-S), Papillary-marginal-alveolar index (PMA), and Russell's Periodontal index (PI) were also estimated together with the PHP index in the same research periods and respective study groups. In addition, during the above-mentioned research periods, oral fluid samples were taken from the patients and sent to the biochemical laboratory of AMU, and their pH indicators were also determined.

In this direction, we carried out the research with 200 people of the city population. All of them voluntarily agreed to have both tests at the same time. The Schiller-Pisarev test allows determining the presence of inflammatory processes in the periodontium in the Greene-Vermillion modification. The importance of this test is that it detects even the beginning stages of inflammation that are not yet visually visible. Lugol's solution is applied to the mucous membrane of the periodontium, it rates 5 points when the mucous membrane is brown, 4 points for light brown color, 3 points for yellow color, and 2 points for straw color. If the mucous membrane is not stained, then it rates 1 point.

In order to conduct a comparative analysis of the characteristics of the adhesion of microorganisms, their structure in different biotopes of the dental-jaw system and types of orthopedic devices, 56 male patients aged only 25 participated in the study,

including 15 patients suffered from mild periodontitis, 14 patients with a deep carious cavity, 15 patients with a bridge-like metal-ceramic prosthesis in the area of the chewing teeth, and 12 patients with a completely healthy oral cavity whose carious cavities were completely removed.

Plaque material was taken from the bottom of the periodontal pockets of patients with periodontitis, from inside the carious cavity of patients with a deep carious cavity, between the intermediate part of the metal-ceramic bridge-like prosthesis and the gum, and from the gingival furrow of healthy individuals and sent to the microbiological laboratory of AMU. In the laboratory, A.actinomycetam-comitans, A.israeli, B.forsythus, B.forsythus, C.albicans, E.coli, F.nucleatum, K.pneumoniae, L.lactis, P.micros, P.niger, S.aureus, S.haemolyticus, S.mutans, S.sanguis, T.denticola and Veilinella species were tested in the collected materials.

The obtained data were processed by statistical methods taking into account modern requirements. The mean values (M), standard error (m), minimum (min) and maximum (max) values, as well as the frequency of occurrence of the quality indicators in the groups, were determined. Correlation analysis was conducted in order to determine the strength of the relationship between the studied indicators. It should be noted that the statistical processing of the results obtained during the research was carried out with the Statistica 7.0 data analysis program.

RESULTS AND DISCUSSION

As a result of the study, deep caries foci were identified in 6 research objects during the dental examinations of patients aged 60 and older (n=23) and this constituted 26.1±9.16% of the respective age group.

As a result of determining the occurrence of moderate and severe periodontitis in patients included in the respective age range, the mentioned forms of periodontitis were recorded in all patients with

deep caries (n=6) and in addition, in 4 patients; in total, in 10 patients, which is 43.5±10.34% of the group.

Thus, 6 patients, or 26.1±9.16% of the patients in the corresponding age group had deep caries and the aforementioned inflammatory diseases of the periodontium together, and the dental morbidity in the group was found in 10 patients, which is 43.5±10.34, of the group (Table 1).

Table 1.

Occurrence of studied dental diseases according to age groups in the patients included in the study

Age groups	N	Total		Caries		PID		Caries +PID	
		Abs.	%	Abs.	%	Abs.	%	Abs.	%
<20	34	24	70.6± 7.81	21	61.8± 8.33	11	32.4± 8.02	7	20.6± 6.93
20-29	31	19	61.3± 8.75	15	48.4± 8.98	12	38.7± 8.75	8	25.8± 7.86
30-39	33	24	72.7± 7.75	16	48.5± 8.70	16	48.5± 8.70	6	18.2± 6.71
40-49	41	28	68.3± 7.27	17	41.5± 7.69	24	58.5± 7.69	13	31.7± 7.27
50-59	38	23	60.5± 7.93	11	28.9± 7.36	23	60.5± 7.93	11	28.9± 7.36
≥60	23	10	43.5± 10.34	6	26.1± 9.16	10	43.5± 10.34	6	26.1± 9.16
Total	200	128	64.0± 3.39	86	43.0± 3.50	96	48.0± 3.53	51	25.5± 3.08

It should be noted that the lower incidence of dental disease in the age groups of 50-59 and 60 years and older compared to other age groups observed during the study is due to the effects of tooth loss on these indicators. During the analysis of the results obtained at this stage of the research, the highest rate of occurrence of deep caries in all age groups was observed in patients under 20 years of age, which is 61.8±8.33% of the group. The lowest indicator, due to the above-mentioned reason, was recorded in the group aged 60 and over, 26.1±9.16% of the group. During the study, the occurrence of deep

caries in all age groups was as follows in ascending order: 60 and over, 50-59, 40-49, 20-29, 30-39, 20 and younger.

According to the results of the study among male patients (n=95), the number of patients who did not consider it necessary to use orthopedic structures then and for this reason refused to carry out orthopedic measures for dental treatment was 11, which is 11.6±3.28 % of the respective gender group (Table 2).

Table 2.

Subjective reasons why patients in need of orthopedic treatment refuse it

Reasons	Male (n=95)		Female (n=105)		P
	Abs	%	Abs	%	
Financial problems	22	23.2±4.33	24	22.9±4.10	>0.05
Fear of orthopedic procedures	9	9.5±3.00	19	18.1±3.76	<0.01
Distrust of orthopedists	7	7.4±2.68	10	9.5±2.86	>0.05
Doubt about the quality of prostheses	10	10.5±3.15	9	8.6±2.73	>0.05
Esthetics of the face are not affected	28	29.5±4.68	11	10.5±2.99	< 0.01
No need	11	11.6±3.28	10	9.5±2.86	>0.05
It is planned in the near future	8	8.4±2.85	22	21.0±3.97	< 0.01
Lack of time	23	24.2±4.39	11	10.5±2.99	< 0.01

Note: P – statistical significance (according to Fisher's exact test)

Due to certain subjective reasons, the number of female patients who avoided orthopedic dental treatment was 10, which is 9.5±2.86% of the total (n=105) female patients (P>0.05). The lost teeth in the oral cavity are replaced by orthopedic treatment, but in fact, the degree of need for dental treatment measures, including orthopedic dental treatment measures, is not determined by the patients themselves but by examinations performed by doctors and dentists specialized in this direction (Table 3).

Table 3.

Dental diseases that occurred due to various orthopedic constructions that had been previously applied

Nosostructure of dental disease	Non-ferrous metal (n=25)		Ferrous metal + ceramics (n=21)		Non-ferrous metal + ceramics (n=5)	
	Abs.	%	Abs.	%	Abs.	%
In the abutment teeth	3	12.0± 6.50	2	9.5± 6.41	1	20.0± 17.89
Regarding the prosthetic construction	8	32.0± 9.33	5	23.8± 9.29	1	20.0± 17.89
In relation to the abutment teeth + Prosthetic construction	2	8.0± 5.43	1	4.8± 4.65	1	20.0± 17.89
Candidiasis	3	12.0± 6.50	1	4.8± 4.65	1	20.0± 17.89
Traumatic situations	2	8.0± 5.43	-	-	-	-
Immunological pathological elements	1	4.0± 3.92	1	4.8± 4.65	-	-
Total	19	76.0± 8.54	10	47.6± 10.90	4	80.0± 17.89

If the lost teeth in the oral cavity are not replaced by orthopedic treatment, caries and its complications can occur with the accumulation of food residues in the spaces between them as a result of displacement of the tooth rows due to the Popov-Godon phenomenon, secondary deformations of the jaws, and separation of the teeth. Based on the above-mentioned, it can be emphasized that this reason given by the patients is nothing but an excuse.

In our study, among male patients, the number of those who indicated that they "plan to take appropriate treatment measures in the near future" as a subjective reason for not taking orthopedic dental interventions was 8, representing 8.4±2.85% of the total number of male patients.

Delaying orthopedic treatment measures is considered unacceptable because it can lead to the occurrence of the above-mentioned complications and cases that require new treatment

measures. In the female gender group, the number of patients who refused orthopedic treatment due to the aforementioned subjective reason was 22, accounting for 21.0±3.97% ($p<0.01$) of the corresponding gender group.

Due to the previously applied orthopedic treatment measures in the respective treatment group, traumatic stomatitis occurred in 2 patients, which includes 8.0±5.43% of research objects in the respective group.

Candidiasis was observed to develop in 9 patients with a metal-ceramic single cap, in 4 patients with fixed bridge-like metal-ceramic prostheses, in 4 patients having plastic prostheses with removable plates, and in the other 4 patients with partial removable bugel prostheses, and in 1 out of 21 patients, or 4.8±4.65% of them, whom we applied ferrous metal-ceramic prostheses before orthopedic treatment. Nevertheless, there were no cases of traumatic injuries related to prostheses in the respective group.

In the course of the study, in 3 patients we used a metal-ceramic single cap and in 2 patients we used fixed bridge-like metal-ceramic prostheses, in a total of 5 patients. However, in patients who had non-ferrous metal-ceramic structures applied before our orthopedic treatment measures, the occurrence of problems both in the abutment tooth and in the orthopedic structures was recorded in 1 patient, and accounting for 20.0±17.89% for the relevant research group.

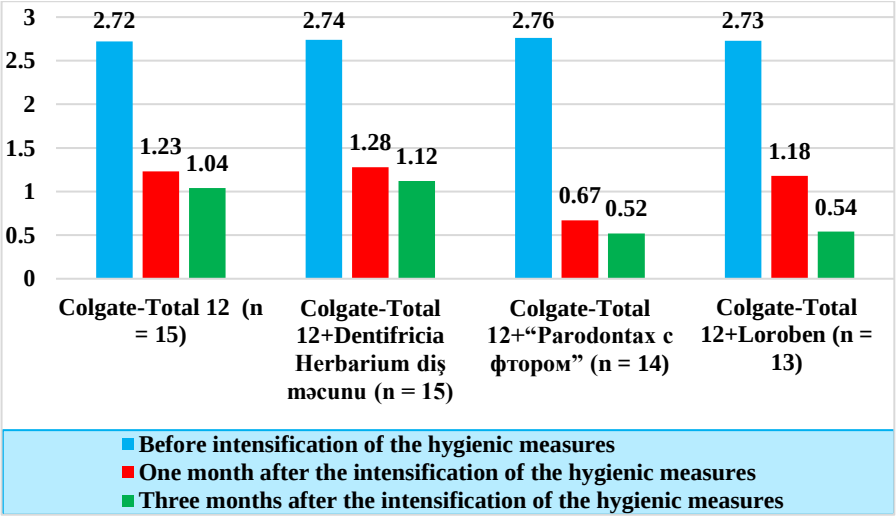
In this research group, the occurrence of candidiasis was also recorded in 1 patient. Despite this, in the relevant research group, pathological elements that could be related to traumatic situations and manifestations of an independent allergic reaction in relation to orthopedic constructions were not found.

In general, 4 out of 5 patients, which was 80.0±17.89% of them, in the respective research group had cases that were not related to the orthopedic treatment performed by us and occurred due to the orthopedic constructions applied to their oral cavity previously.

Fifteen patients who needed orthopedic treatment and for this purpose we applied metal-ceramic bridge-like prostheses in the area

of their chewing teeth were included in the research group. The patients brushed their teeth with "Colgate-Total 12" toothpaste in the morning after meals and "Herbarium" toothpaste in the evening before going to bed for personal hygiene measures. One week after the application of fixed bridge-like prostheses and before the mentioned individual hygiene measures were optimized as we proposed when performing examinations based on the OHI-S hygienic index, the average indicator of the relevant index for the group was 2.74±0.046, which indicates the unsatisfactory hygienic condition of the oral cavity during the relevant research period.

One month after the start of the measures performed by adding toothpaste with a predominant composition of natural remedies to the traditional personal hygiene measures, the index decreased significantly and was 1.28±0.035% indicating the satisfactory situation in the oral cavities of these patients due to the intensification of the hygiene measures (Graph 1).



Graph 1. The effect of various hygienic means on the hygienic condition of the oral cavity of patients with bridge-like prostheses according to the OHI-S index

During examinations conducted 3 months after the intensification of hygienic measures, the OHI-S index was found to be 1.12±0.030, which is lower than the analogous indicators of the other two research periods ($p<0.001$).

In the research group of 14 patients, fixed bridge-like prostheses were applied in the area of chewing teeth during orthopedic treatment and the patients were instructed to brush their teeth with "Colgate-Total 12" toothpaste once in the morning and once in the evening before going to bed with " Parodontax with fluoride" therapeutic toothpaste for hygienic measures. One week after the application of bridge-like prostheses, the OHI-S index was found to be 2.76±0.060 and based on this index, it could be concluded that the hygienic condition of the oral cavities of the patients was unsatisfactory. Nevertheless, in addition to traditional personal hygiene measures, when 1 month passed after brushing the teeth with "Parodontax with fluoride" therapeutic toothpaste, the corresponding index decreased many times to 0.67±0.046, which in contrast to the results of the examinations carried out in this research groups during the previous research period, shows that the oral cavity of the patients is better than satisfactory condition. Such a sharp adaptation of the mentioned dissimilar high-priority species of microorganisms to biotopes of periodontal pockets and carious cavities of teeth directly confirms that microorganisms cause specific nosoforms of these organs due to their pathogenic properties.

Thus, the *A.actinimycetemcomitans* species was found in only 2 out of 15 biological samples taken from the periodontal pockets of patients with mild periodontitis, which is 13.3±8.78% of the samples taken from all patients with periodontitis. Nevertheless, this species was not recorded in any of the biological materials of carious cavity origin taken from 14 patients with no periodontitis, with carious cavity, and no other general somatic pathology (1 sample from each patient). Microbiocenosis of periodontal pockets of the *A. israeli* species was detected in 4 of the biological samples (n=15) taken from the studied patients or in 26.7±11.42% of them. While the *S.aureus* species was not found in any of the biological samples obtained from periodontal pockets

(n=15), representatives of this species were found in 10 samples (n=14) taken from carious cavities (71.4±12.07%).

The *S. haemolyticus* species was found in 10 of the biological materials (n=15) obtained from the periodontal pockets of patients with mild periodontitis, which is 66.7±12.17% of the respective patients.

In the microbiological materials obtained from carious cavities (n=14), the occurrence of the relevant microorganism was in 10 samples, which is 71.4±12.07% of all samples.

In a research group of 14 patients who applied fixed bridge-like prostheses in the area of chewing teeth during orthopedic treatment and were instructed to brush their teeth with "Colgate-Total 12" toothpaste 1 time in the morning and with "Parodontax with fluoride" therapeutic toothpaste 1 time in the evening before going to bed as a hygienic measure, 1 week after the application of bridge-like prostheses, the pH in oral fluid samples was 6.17±0.125.

In this research group, the increase in the pH indicator based on the proposed individual hygiene plan was also recorded during the study of oral fluid samples collected from patients in the 3rd month of the study. The average pH indicator for the group was 6.78±0.062.

Representatives of the *A. actinomycetamocomitans* species were found in plaque samples (n=12) collected from the surface of the orthopedic constructions in 9 of 12 patients who applied partially removable bugel prostheses for orthopedic treatment, or in 75.0±12.50% of the total cases in the respective treatment group. B. forsythus representatives occurred in 11 of the biological materials we obtained from the respective treatment group, which makes up 91.7±7.98% of the plaque samples obtained from all bugel prostheses.

The *A.actinomycetamocomitans* species was found in 10 of the samples collected from the surface of the respective orthopedic structures of the patients (n=12) in the conventional treatment group, where we used removable prostheses with plastic plates for orthopedic treatment, which is 83.3±10.76% of the all biological materials in the respective treatment group. The P. Micros species was detected in the dental plaque samples obtained from 9 pieces of plate prostheses or 75.0±12.50% of them applied in the respective treatment group.

C. albicans single-celled fungus was found in the plaque samples collected on the orthopedic constructions of 11 patients in the conventional treatment group, who applied partially removable bugel prostheses for orthopedic treatment, and this accounts for 91.7±7.98% of the total patients. Representatives of the *H. influenzae* microorganism were found in 9 of the plaque samples obtained from the bugel prostheses of the patients in the respective treatment group, which means 75.0±12.50% of the total samples obtained from this group.

During the study of plaque samples (n=14) obtained from the gingival furrows of teeth where single metal-ceramic caps were used for orthopedic treatment, representatives of *C.albicans* microfungus were found in 12 or 85.7±9.35% of them. Representatives of the *H. influenzae* species were found in 11 of the plaque samples obtained from this treatment group, and it covers 78.6±10.97% of the total biological materials in the corresponding group. We found the *S.aureus* species in the samples obtained from the gingival furrows of the teeth of 9 patients in the respective treatment group, which means 64.3±12.81% for this treatment group.

During the microbiological analysis of the bacteria collected from the surfaces of the removable prostheses with plastic plates applied for orthopedic treatment, representatives of *B. forsythus* species were found in 11 out of 12 patients, or 91.7±7.98% of them. In the corresponding biological materials obtained from the respective treatment group (n=12), we found both *C.albicans* and *H.influenzae* species in 10 plaque samples, accounting for 83.3±10.76% of the research objects in the respective treatment group.

During the microbiological analysis of the plaque samples collected from the surfaces of the respective orthopedic constructions applied to the patients in the conditional treatment group who used the partially removable Bugel prostheses for orthopedic treatment, representatives of the *P. micros* species were found in 11 out of 12 patients, which is 91.7± 7.98% of the total cases in this group. The presence of staphylococcal and streptococcal representatives such as *S.aureus* and *S.mutans* in the analogous biological materials we obtained for the respective group was the same as in the case of *P.micros*:

91.7±7.98% per treatment group, occurring in 11 samples per case. Nevertheless, in the respective treatment group, the *P. gingivalis* species, which is important in the occurrence of periodontal diseases, was found in high activity in 8 biological samples, which is 66.7±13.61% of the total cases in this group.

However, the *P.ginigvalis* species was found in 13 samples in the conventional treatment group of 14 patients who used single metal-ceramic caps for orthopedic dental treatment, which is 92.9±6.88% of the total plaque samples obtained from the gingival furrows. Since *P. gingivalis* mainly plays a role in the development of periodontal diseases, it is mostly found in periodontal tissues, including the surface of prostheses coming out of the gingival furrow. The same situation is observed with *S. mutans*, which has a decisive role in the development of caries. Thus, in the conventional treatment group where we applied single caps for orthopedic dental treatment, the occurrence of the corresponding species was relatively higher than in the groups where we applied partially removable bugel prostheses and prostheses with plates. As in the case of *P.gingivalis*, it occurred in 13 samples, which is 92.9±6.88% of all samples in this group. In the treatment group where we applied single caps, the *P.micros* species was found in the 12 dental plaque samples obtained from the periodontal furrows of the teeth where we applied the appropriate orthopedic constructions, which is 85.7±9.35% of this treatment group.

In the conventional treatment group (n=12) where we used prosthetics with removable plastic plates for orthopedic dental treatment, 7 of the biological materials taken from the surfaces of the prostheses, or 58.3±14.23% of them, had representatives of *P. gingivalis*, the main causative agent of periodontal diseases and it was significantly less than the analogous indicators of the treatment groups in which we applied single caps and bugel prostheses for treatment. We found representatives of the *S.aureus* species in the dental plaque samples obtained from 8 prostheses in the respective treatment group, which covers 66.7±13.61% of the analogous biological materials obtained in the respective group (Table 4).

Table 4.

The species composition of microorganisms with an incidence close to 70% found in the biological materials obtained from patients with various orthopedic constructions

Mikro-organisms	Metal-ceramic single cap (n=14)		Bugel prosthesis (n=12)		Partially removable prosthesis with plastic plate (n=12)		Total (n=38)	
	Abs	%	Abs	%	Abs	%	Abs	%
A.actinomy-cetamocomitans	11	78.6± 10.97	9	75.0± 12.50	10	83.3± 10.76	30	78.9± 6.61
B.forsythus	13	92.9± 6.88	11	91.7± 7.98	11	91.7± 7.98	35	92.1± 4.37
C.albicans	12	85.7± 9.35	11	91.7± 7.98	10	83.3± 10.76	33	86.8± 5.48
H.influenzae	11	78.6± 10.97	9	75.0± 12.50	10	83.3± 10.76	30	78.9± 6.61
P.micros	12	85.7± 9.35	11	91.7± 7.98	9	75.0± 12.50	32	84.2± 5.92
P.gingivalis	13	92.9± 6.88	8	66.7± 13.61	7	58.3± 14.23	28	73.7± 7.14
S.aureus	9	64.3± 12.81	11	91.7± 7.98	8	66.7± 13.61	28	73.7± 7.14
S.mutans	13	92.9± 6.88	11	91.7± 7.98	11	91.7± 7.98	35	92.1± 4.37
S.pyogenes	12	85.7± 9.35	10	83.3± 10.76	11	91.7± 7.98	33	86.8± 5.48
S.sanguis	11	78.6± 10.97	10	83.3± 10.76	10	83.3± 10.76	31	81.6± 6.29
Veillonella species	11	78.6± 10.97	9	75.0± 12.50	10	83.3± 10.76	30	78.9± 6.61

In the group of patients who used bugel prostheses for the orthopedic treatment, the *S.pyogenes* and *S.sanguis* species occurred in 10 plaque samples deposited on the surfaces of the respective prostheses, which was 83.3±10.76 for each microorganism species in the respective treatment group.

Different species of the *Veillonella* genus were found in 9 samples accounting for 75.0±12.50% of the biological materials obtained from the surfaces of orthopedic constructions from the respective treatment group. In patients of the conventional treatment group with single caps for orthopedic dental treatment, the *S. pyogenes* species was found in 12 samples (n=14) accounting for 85.7±9.35% of the samples (n=14) obtained from the periodontal furrows of the teeth where we fixed the construction.

In the biological materials obtained from the periodontal fissures of the teeth in which we applied caps for the respective treatment group, the occurrence of both *S.sanguis* and *Veillonella* species was in 11 samples separately for both cases, which is 78.6±10.97% of the total samples in the respective group.

During the microbiological analysis of the samples obtained from the surfaces of the prostheses of patients treated by orthopedic dentistry with removable prostheses containing plastic plates, the occurrence of both *S.mutans* and *S.pyogenes* species was in 11 samples for each case in the respective treatment group, which is 91.7±7.98 % of all samples.

The presence of the *S.sanguis* species in the samples (n=12) collected from the prosthetic surfaces in the respective treatment group was observed in 10 samples accounting for 83.3±10.76% of the research objects in the treatment group. In this treatment group, the occurrence of different species of the genus *Veillonella* was the same as the corresponding indicator of the species *S.sanguis*, i.e., it was in 10 patients, which is 83.3±10.76% of all samples.

Representatives of the *P.micros* species were found in 32 of the samples (n=38) obtained from all patients who used all three types of orthopedic constructions for orthopedic dental treatment, which is 84.2±5.92% of the total research objects. *P. gingivalis*, which has a special role in the development of periodontal diseases, and *S. aureus*, which is responsible for a number of inflammatory reactions, were found in 28 of the samples (n=38) obtained from the patients for each case, which is 73.7±7.14% of the total patients.

Nevertheless, the *S. mutans* species, which is responsible for cariogenic processes, was found in 35 out of 38 plaque samples obtained from the periodontal furrow of the teeth where we had applied metal-ceramic single caps for orthopedic dental treatment, and from the prosthetic surfaces of the patients who applied dentures with bugel and plastic plates, which was an average of 92.1±4.37% of research objects for all treatment groups. During the detection of *S.pyogenes* from the respective biological materials, the relevant microorganism was found in 33 of them, which is 86.8±5.48% of the total samples. We found the *S.sanguis* species in 31 samples out of the total biological materials obtained, which made up 81.6±6.29% of the research objects. The total occurrence of different species of the *Veillonella* genus in the samples obtained from all conventional-treatment groups included 30 samples, which made up 78.9±6.61% of the total research objects (n=38) where we performed orthopedic dental treatment.

In general, the *A.actinomycetamocomitans* species were found in 30 out of the 38 samples obtained from the gingival furrows of the patients wearing tooth prostheses with a single metal-ceramic cap, partially removable bugel and partially removable plastmass prostheses with caps and from the plaque samples of bugel and plate prostheses we used for orthopedic treatment, which is 78.9±6.61% of all samples. The *B.forsythus* species was found in 35 samples of the respective biological material, which is 92.1±4.37% of all tooth plaque materials. *C.albicans* microfungus was found in 33 of the respective plaque samples accounting for 86.8±5.48% of the total samples. The respective indicator for the *H.influenzae* species was found in 30 samples, which is 78.9±6.61% of the total materials.

For orthopedic treatment, fixed bridge-like prostheses with metal-ceramic composition were applied in the area of chewing teeth in a research group of 13 patients, and in order to intensify personal hygiene measures, together with brushing the teeth with "Colgate-Total 12" toothpaste in the morning after meals and in the evening before going to bed, they were instructed to rinse the oral cavity with the "Loroben" mouth rinse containing 0.12% chlorhexidine gluconate and 0.15% benzydamine-hydrochloride in addition to brushing teeth.

During the examination and calculations of the OHI-S index, 1 week after the application of the respective orthopedic constructions to the oral cavity, its value was found to be 2.73±0.061, which indicates the unsatisfactory hygienic condition of the oral cavity of patients during the research period.

Nevertheless, 1 month after the intensification of personal hygiene measures combined with the "Loroben" preparation, the OHI-S index decreased, and the average for the group decreased to 1.18±0.040, indicating the satisfactory hygienic condition of the oral cavities in the respective study groups.

In general, besides the application of fixed prostheses with metal-ceramic composition to the area of chewing teeth we used the hygiene measures with the help of various personal hygiene tools in patients who need orthopedic treatment. The patients were instructed to brush their teeth with "Colgate-Total 12" toothpaste in the morning after meals and in the evening before going to bed, and to rinse the oral cavity with a mouthwash containing 0.12% chlorhexidine gluconate and 0.15% benzydamine hydrochloride "Loroben". We observed a higher colonization ability of the *Lactobacillus* species in the research group of 13 patients in comparison to other research groups due to the effect of personal hygiene products applied. Rehabilitation of the function of the jaw system is not only the goal of dental orthopedics but also one of the main tasks in protecting the health of the population. Despite the wide network of orthopedic services and the provision of all-encompassing, affordable orthopedic care to all social classes of the population, many unsolved problems require a comprehensive study of the complex issues related to the orthopedic dental status of the population and the state of its demand for the rehabilitation of the dental and jaw system. The high level of this demand is often related to the fact that intensive colonization of the oral cavity with various representatives of the microflora, their adhesion and metabolism leads to early failure of orthopedic devices and the development of dental disease, which leads to the formation of new defects in the tooth rows and creates a demand for replacement of already installed orthopedic devices. Considering the above, the research aimed to study the effects

of the orthopedic constructions applied in patients in need of orthopedic treatment on the adhesion properties such as colonization and presence of microorganisms in the oral cavity, based on various dental parameters.

CONCLUSIONS

1. During the examination of the oral cavity of 40 patients who were to be applied fixed bridge-like prostheses for orthopedic treatment, it was recorded that 4 of them had previously applied plastic-containing orthopedic construction in their oral cavity, accounting for 10.0±4.74% of the patients in this treatment group [10].
2. It was found that candidiasis developed in 1 out of 21 patients, or 4.8±4.65% of them, to whom we applied non-metallic metal-ceramic prostheses before our orthopedic treatment. In patients with deep caries (n=6), moderate and severe periodontitis was recorded in 4 patients [12].
3. During the study of the samples (n=14) obtained from the gingival furrows of the patients to whom we had applied only (single) metal-ceramic caps for orthopedic treatment, representatives of the *C.albicans* microfungus were found in 12, accounting for 85.7±9.35% of them [3, 6]. During the microbiological analysis of plaque collected from 12 patients who used prostheses with removable plastic plates for orthopedic treatment, representatives of the *B. forsythus* species were found in 11 of them, which is 91.7±7.98% [3, 6].
4. During the study of the samples (n=12) collected from partially removable bugel prostheses for orthopedic treatment, representatives of the *A. actinomycetamocomitans* species were found in 75.0±12.50% of the cases. While *B. forsythus* representatives were found in 91.7±7.98% of the biological materials we obtained for the appropriate treatment group [2, 9].
5. The colonization capacity of the *Lactobacillus* species was higher in the study group consisting of 13 patients compared to other study

groups due to rinsing their mouths with "Loroben" mouthwash along with the effect of individual hygiene measures [8].

PRACTICAL RECOMMENDATIONS

1. Before performing orthopedic dental measures, it is more appropriate to conduct a microbiological analysis of various diseases and conditions in the oral cavity and taking these results into account, to implement treatment measures.
2. Ceramic-coated prostheses are more inert than ferrous-containing orthopedic structures and are recommended.
3. In addition to traditional personal hygiene measures, brushing teeth with the therapeutic toothpaste "Parodontax with fluoride" results in a satisfactory condition in the oral cavities of the patients.
4. When using non-removable prostheses with bridge-like metal-ceramic composition, the application of the combination of the toothpaste "Parodontax with fluoride" and the Colgate Total 12 daily toothpaste will show an effective result in the prevention of gum diseases.

LIST OF PUBLICATIONS ON THE TOPIC OF THE DISSERTATION

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