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Comparison of microbiological parameters in the early and late stages of prosthetics on dental implants

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Abstract: On patients with installed dental implants and having an implant-abutment connection system using a fixing screw, the microbiological status of the oral cavity was studied in the dynamics of observation with and without transition of the platform to the abutment. All patients were divided into 2 groups: 1 group consisted of 9 patients with an implant-abutment system without platform switching; Group 2 consisted of 10 patients with a platform-to-abutment transition element.

The material for the microbiological study was a biomaterial from the soft tissue mucosa around the abutment. The study of the dynamics of the microbial flora in patients with the transition of the platform on the abutment relative to the indicators before prosthetics, showed mainly a decrease in the quantitative indicators of representatives of both its stabilizing and aggressive components.

Keywords: microflora of the oral cavity, implants, abutment, treatment, prosthetics.

Introduction: The microflora of the oral cavity is formed in the process of evolution between the human body and microorganisms and represents a peculiar, complex and stable microbiocenosis, which is a favorable environment for the growth and maintenance of the vital activity of microorganisms. Microorganisms that are more or less frequently selected from the body of a healthy person form its normal microflora. According to the variety of species and the number of microorganisms, the predominant position in the oral cavity is occupied by bacteria [1, 3,4, 10].

One of the main functions of the normal oral microflora is to maintain a relatively stable state of specific and non-specific, humoral and cellular mechanisms of immunity. The protective role of normal microbial flora in relation to pathogenic and opportunistic bacteria is manifested owing to the synthesis of bactericidal substances (diplococcin, acidophilus, lactocidin, lactoline, hydrogen peroxide, etc.), organic acids (lactic, acetic, ketoglutaric and succinic). Normal microflora takes part in the synthesis of vitamins B, PP, K, C, improves the synthesis and absorption of vitamins D and E, folic and nicotinic acids that enter the body with food. At the same time, many microorganisms of the oral cavity produce organic acids in the course of their vital activity, which contributes to the development of decay, and under certain conditions, some microorganisms are able to cause deeper pathological processes in the oral cavity [2,5,6,11].

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Considering the above, it is quite relevant to study the microbiocenosis of the oral cavity in time of various prosthetic manipulations, because the percentage of failures in this area of prosthetic treatment is still quite high (7,8,9). And oftentime they are associated with mechanical causes (microtrauma in the joint of the implant and abutment), and the influence of pathogenic microflora, usually acting in association. We can't avoid the presence of an interspace between the implant and the abutment in using an implant consisting of two parts. Bacteria and their metabolic products can and will colonize this area, and can initiate the development of an inflammatory reaction in the soft tissues surrounding the implant.

The purpose of the researchwas to study the microbial landscape of the oral cavity in individuals without and with the transition of platforms to abutment.

Material and methodsof the research. There were studied patients after dental implantation who had got treatment in the department of Prosthetic Dentistry/ The installed dental implants are the IMPRO company' implants of an implant-abutment connecting system with a fixing screw. All patients were diagnosed with "Partial secondary adentia". All patients were divided into 2 groups: group 1^{st} consisted of 9 patients with an implant-abutment system without switching platforms; group 2^{nd} consisted of 10 patients with a platform-to-abutment transition element. We observed the patients in the dynamics: a) before the prosthetics, b) in the 3^{rd} monthes after prosthetics,c) in the 6^{th} monthes after prosthetics.

The material for the microbiological study was a biomaterial on a soft tissue mucosa around the abutment. The material was placed in vials with Stewart's medium and within no more than 3 hours was transferred to the microbiological laboratory.

Results and discussion. There was revealed an almost complete list of typical microorganisms of an oral cavity in the biomaterial from the soft tissue mucosa around the abutment. A comparative analysis of the occurrence of microorganisms showed that the type of microorganisms did not depend on the implant system, the shape and the size of its connection, the installation time.

Almost half of the permanent resident microorganisms are facultative and obligate anaerobic streptococci, which are represented by S. mutans, S. sanguis, S. mitis, S salivarius and peptostreptococci, and the other half are represented by Veylonella and diphteroids.

Other representatives of the oral microflora (staphylococci, lactobacilli, bacteroids, Neisseria, fungi, protozoa) are detected more rarely than streptococci, vaillonella and diphteroids. These ones were formed as a result of the mutual adaptation of the macro- and microorganism, because there are antagonistic or synergistic relationships between microorganisms.

The data presented in the table shows a quantitative evaluation of each representative of the resident microflora of the oral cavity. The analysis of the bacteria association in the area of periimplantation cuff after the implant installation

without prosthetics, we could note a rather stable contentof the microflora, which did not depend on the timing and size of the implant installation. Microorganisms such as S. mutans, S. salivarius, S. mitis, Veylonella, peptostreptococci, fusobacteria were detected in different concentrations in oral cavity of all the examined patients (100%).The occurrence of staphylococci, mycobacteria, anaerobic diphteroids was up to 30-40% of cases.

We initially evaluated the microbial content of the oral cavity in patients before prosthetics, It was found that S. mutans amounted to (1.9±0.12) x104; S. salivarius (4.2±0.21) x105, S. sangvist (4.2±0.21) x105, and S. aureus (5.1±0.20) x106, Fusobacterium spp. (2.3±0.20) x104 CFU/g, Neisseria spp., (4.4±0.21)x106 (CFU/g); Corynebacterium spp. (2.6±0.20)x105 CFU/g; C. pseudodiphthericum (2.4±0.20) x106 CFU/g; Enterobacterium spp. (4.5±0.12) x106 CFU/g .

The comparative analysis of microorganisms quantitative change in the 1st group of patients without switching platforms in the dynamics: before the prosthetics, in the 3rd monthes after prosthetics and in the 6th monthes after prosthetics.

Table 1

Qualitative and quantitative content of the oral basic microflora in patients after dental implantation without transition to platforms

Types of microorganisms	***Terms of research***		
	Before prosthetics	***After 3 months***	***After 6 months***
	(KOE/г)		
Streptococcus mutans	(1,9±0,12) x10^4	(3,2±0,20)x1 0^{5*}	(3,6±0,19)x1 0^{5*}
Streptococcus epidermidis	(2.1±0,20) x10^5	(4,1±0,20)x1 0^{5*}	(4,5±0,21)x1 0^{5*}
Streptococcus sanguis	(4,2±0,21) x10^5	(4,1±0,21)x1 0^5	(5,2±0,19)x1 0^5
Streptococcus salivarius	(5,3±0,20) x10^6	(5,2±0,20)x1 0^6	(4,7±0,20)x1 0^6
Neisseria spp.	(4,4±0,21) x10^6	(2,6±0,21)x1 0^{5*}	(2,3±0,20)x1 0^{5*}
Fusobacterium spp.	(2.3±0,20) x10^4	(4,1±0,20)x1 0^{5*}	(4,5±0,21)x1 0^{5*}
Staphylococcus aureus	(5,1±0,20) x10^6	(4,8±0,21)x1 0^6	(4,2±0,20)x1 0^6
Corynebacterium spp.	(2.6±0,20) x10^5	(4,1±0,20)x1 0^{5*}	(4,5±0,21)x1 0^{5*}

C.pseudodiphthericum	(2.4±0,20) x10^{6}	(6,4±0,20) x10^{5}	(4,8±0,21) x10^{5}
L.buccalis	(1.8±0,20) x10^{4}	(5,6±0,20) x10^{4*}	(4,9±0,16) x10^{4*}
V.parvula	(8,6±0,19) x10^{6}	(3,0±0,20)x1 0^{6}	(3,2±0,22)x1 0^{6}
B.gingivalis	(5,8±0,11) x10^{6}	(6,6±0,18)x1 0^{4*}	(5,8±0,21)x1 0^{4*}
Enterobacterium spp.	(4,5±0,12) x10^{6}	(4,2±0,21)x1 0^{5*}	(4,5±0,20)x1 0^{5*}
Peptostreptococcusanaerobius	(6,2±0,21) x10^{6}	(4,1±0,20)x1 0^{5*}	(4,7±0,21)x1 0^{5*}

Note: * - P< 0.05 the difference is significant concerning to the indicators before prosthetics

It can be noted a rather stable content of the microflora in the dynamics after 3 months, i.e. the representatives of the oral microflora are detected with almost the same frequency and the same quantitative content. Thus, the amount of Streptococcus sanguis almost does not change, before prosthetics this indicator was (4.2±0.21)x105 CFU/ml. At the 3rd month the amount of this mat remained almost the same and was 4.1±0.21 x105 CFU/ml. At the 6th month, the quantitative indicator of this mat increased slightly and was (5.2±0.19) x105 CFU / ml. Another important representative of the oral microbiocenosis is Streptococcus salivarius. Its amount before prosthetics was 5.3±0.20 x106 CFU/ml. After 3 and 6 months after prosthetics light changes were observed from 5.2±0.20 x106 CFU/ml to monitoring 4.7±0.20 x106 CFU/ml, respectively. The representative of anaerobic streptococci-Peptostreptococcus anaerobius, was detected in an amount of up to 6.2±0.21 x106 CFU / ml before prosthetics, slightly decreased by the 3rd month of monitoring – 4.1±0.20 x105 CFU/ml, but by the 6th month there was a slight increase to 4.7±0.20 x105 CFU/ml. In this group of patients there was a positive trend in the amount of Corynebacterium spp. during all follow-up periods relative to the parameters before prosthetics (2.6±0.20 x 105 CFU/ml.) and was characterized by an increase in the number of bacteria by 3 months to 4.1±0.20 x 105 CFU/ml and by 6 months to 4.5±0.20 x105 CFU/ml.

We also identified representatives of aggressive microflora, among which we should note the Enterobacterium spp., the number of which decreased slightly in the dynamics of observation. Thus, before prosthetics, it was 4.5±0.12 x106 CFU/ml, by the 3rd month it was 4.2±0.21 x105 CFU/ml, and by the 6th month it practically did not change 4.5±0.20 x105 CFU/ml. The detection of such untypical bacteria may

indicate the presence of dysbiosis in the area of the implant-gingiva contact. It is also necessary to note the presence of Staphylococcus aureus in the contents of the crops and almost no dynamics during the observation. Thus its amount was 5.1±0.20 x106 CFU/ml at the beginning of the study and up to 4.2±0.20 x106 CFU/ml by the end of the observation.

The dynamics considering of the microbial flora in patients with the transition of the platform on the abutment relative to the indicators before prosthetics, a decrease in the quantitative indicators of representatives of both the stabilizing and aggressive components was revealed.

Thus, at the 3rd month of monitoring there was a slight increase in the number of S. mutans (2.8±0.14)x104 CFU/ml) and S. epidermidis (2.7±0.21)x105 CFU/ml) relative to the data before prosthetics (1.9±0.12)x104 CFU/ml and (2.1±0.20)x104 CFU/ml, respectively). By the 6th monththere is a decrease of S. mutans to (2.5±0.15) x104 CFU / ml) and S. epidermidis to (2.4±0.21)x105 CFU / ml relative to the previous term, but they remain slightly above the level of these indicators before prosthetics.

Table 2

Qualitative and quantitative composition of the main microflora of the oral cavity in persons with the transition of the platform on the abutment

Types of microorganisms	***Terms of research***		
	Before prosthetics	***After 3 months***	***Before prosthetics***
	(КОЕ/г)		
S. mutans	(1,9±0,12)x10^4	(2,8±0,14)x10^4	(2,5±0,15)x10^4
S.epidermidis	(2.1±0,20)x10^5	(2,7±0,21)x10^5	(2,4±0,16)x10^5
S. sanguis	(4,2±0,21)x10^5	(3,2±0,16)x10^5	(2,6±0,12)x10^5
S.salivarius	(5,3±0,20)x10^6	(4,4±0,23)x10^{5*}	(3,8±0,16)x10^{5*}
Neisseria spp.	(4,4±0,21)x10^6	(2,1±0,18)x10^{5*}	(1,64±0,23)x10^{5*}
Fusobacterium spp.	(2.3±0,20)x10^4	(3,6±0,17)x10^4	(2,8±0,21)x10^4
S. aureus	(5,1±0,20)x10^6	(3,8±0,21)x10^{5*}	(3,2±0,20)x10^{5*}

Corynebacterium spp.	(2.6±0,20)x10^{5}	(5,4±0,23)x10^{5}	(5,8±0,21)x10^{5}
C.pseudodiphthericum	(2.4±0,20) x10^{6}	(5,6±0,20) x10^{5*}	(4,4±0,18) x10^{5*}
L.buccalis	(1.8±0,20) x10^{4}	(4,6±0,20) x10^{4}	(3,8±0,16) x10^{4}
V.parvula	(8,6±0,19) x10^{6}	(4,0±0,20)x10^{5*}	(2,8±0,12)x10^{5*}
B.gingivalis	(5,8±0,11)x10^{6}	(4,2±0,14)x10^{4*}	(3,8±0,21)x10^{4*}
Enterobacterium spp.	(4,5±0,12)x10^{6}	(3,2±0,21)x10^{5*}	(2,5±0,20)x10^{5*}
P.anaerobius	(6,2±0,21)x10^{6}	(3,1±0,20)x10^{5*}	(2,7±0,21)x10^{5*}

Note: * - P< 0.05 the difference is significant concerning to the indicators before prosthetics

Streptococcus sanguis decreases from 4.2±0.21x105 CFU/ml indicators before prosthetics to 3.2±0.16x105 CFU/ml by the 3rd month, and to 2.6±0.12x105 CFU/ml by the end of the research. At the same time, the dynamics of Streptococcus salivarius behavior is as follows: 5.3±0.20 x106 CFU/ml – before prosthetics, 4.4±0.23 x106 CFU/ml – at 3th months, and 3.84±0.16 x105 CFU/ml – at 6th months from the start of the research.

The quantitative index of anaerobic streptococci Peptostreptococcus anaerobius in patients of this group before prosthetics was 6.2±0.21x106 CFU/ml, significantly decreased by 3th months of observation to 3.1±0.21x105 CFU/ml and by 6th months of observation decreased to 2.7±0.21x105 CFU/ml. The number of corynebacteria before prosthetics was at the level of 2.6±0.20x105 CFU/ml, in the dynamics of observation by 3th months the level reached 5.4±0.23 CFU/ml and by 6th months it was further increased to 5.8±0.21x105 CFU/ml.

Corinobacteria actively reduce molecular oxygen in the course of their life and synthesize vitamin K, which contributes to the development of obligate anaerobes. According to this, it can be noted that an increase in the number of detected corynebacteria in subsequent follow-up periods positively characterizes the dynamics of the oral microflora in these patients.

For aggressive microflora, the following dynamics were noted. The quantitative index of enterococci also characterized the positively dynamics of the microbial landscape of the oral cavity in this group of patients at all observing periods, i.e., if

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before prosthetics their number was 4.5±0.12 x106 CFU/ml, then by 3th months there was a decrease in their number to 3.2±0.21 x105 CFU/ml, and by 6th months they were 2.5±0.20 x105 CFU/ml.

Thus, the results of the research allow us to conclude that in cases when the platform is switched to an abutment a positive microbiocenosis is formed in patients at the 6th month after prosthetic on implants, but the value of all the representatives of microorganisms have been studied remains at high levels. At the same time, the microbial landscape is characterized by the prevalence of stabilizing types of bacteria (Streptococcus saiivarius, Streptococcus sanguis, Corynebacterium spp.). However, the frequency of such untypical microorganisms for the oral cavity, such as enterobacteria, enterococci, indicates the development of dysbiosis in the area of implant-gingival contact.

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