



INFLUENCE OF NANOHYBRID COMPOSITE FILLING MATERIALS ON ADHESION OF MICROFLORA AND CYTOKINE PROFILE OF THE MOUTH CAVITY

Shukurova U.A. ^{1,a},

Gafforova S.S. ^{2,b},

Gafforova M.I. ^{3,c}

¹Doctor of Medicine, Docent, Tashkent State Dental Institute

²Doctor of Philosophy, Assistant, Tashkent State Dental Institute

³Assistant, National University of Uzbekistan named after Mirzo Ulugbek, Tashkent, Uzbekistan

^ashua1981@mail.ru, ^bsevaragaffarova95@gmail.com

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ABSTRACT

Gradation of the quality of composite restorations according to the level of risk and types of individual therapeutic and preventive measures based on the differentiated level of risks of reducing the quality of restorations, allows to increase the long-term quality results by more than 45.00%

And the relevance of the study . The growth in demand for dental composites is due to the growth in aesthetic restorations. In modern conditions, improving the quality of dental care is becoming not only a medical, but also a social and economic problem, since more than 50% of repeated interventions are for the restoration of filling defects or their replacement, which takes a third of the working time of a dentist [1, 4,12].

To improve efficacy and clinical use improves the chemical composition of the filler and the organic matrix . Changing the size and content of the filler improved mechanical properties such as flexural strength, tensile strength, polymerization shrinkage, microhardness and made further use in chewing restorations possible [1,2,5,10].

The microbiota of the oral cavity in a healthy state is diverse, in a healthy person the number of resident species is estimated at between two hundred and fifty and three hundred different species, of which the genus Streptococcus is the most numerous . The influence of the chemical composition of restorative materials on the adhesive properties to various microorganisms of the oral cavity has been proven [3,7,9,11]. Several factors influence the formation and maintenance of the oral microbiota, including the behavior and defense mechanisms of the body, the local environment and the microorganisms themselves, that is, their ability to attach, aggregate, interact with other species, as well as their virulence [1,4,8,12] .

The oral cavity offers several different niches for microbial colonization and one of them is the surface roughness of the restorations, which varies in relation to the size of the inorganic filler of the composites [5,7,9]. Determining the effect of composite fillings on the immuno -microbiological state of the oral cavity and on the surface of restorations once again emphasizes the relevance of this study.



Purpose of the study. To evaluate the level of adhesion of S. Mutans to the surface of nanohybrid composite restorations and the cytokine profile of the oral fluid in association with their quality.

Materials and research methods. The study involved 86 adult patients aged 18 to 60 years, including 55 women (64.0±3.2%) and 31 men (36.0±1.8%). In relation to the used filling materials, 4 groups were identified. Patients received fillings for all classes of Black from Charisma - 45 fillings, DenfilN - 44 fillings, I - XCiteLCN - 49 fillings and from Firuze Grand - 51 fillings.

The assessment of the quality of the restoration was carried out according to the criteria of Ruge (1998). The proposed criteria have received the name modified USPHS criteria (United States Public Health Service - USPHS), and have become widely used to evaluate fillings and restorative tabs. Our patients were screened for the following criteria: marginal adaptation (MA), anatomical shape (AF), restoration surface roughness (SR), secondary caries (VC) and restoration color match (CR). The assessment of these criteria was carried out according to 4 rating scales A (Alfa), B (Bravo), C (Charlie). The clinical characteristics were determined immediately after filling, after 6 and after 12 months.

During the first visit, a simplified plaque index, OHI-S, was used in all study patients to determine the amount of plaque (JCGreen, JRVermillion, 1964). Then, dental plaque was taken for microbiological and immunological studies. Next, a set of measures was taken to conduct professional oral hygiene, which is aimed at removing the biofilm and polishing the surface of the teeth.

Microbiological studies were also carried out. (adhesion level of S. mutans on the restoration surface) and immunological (concentration of pro- (TNF- α , IL-6) and anti-inflammatory (IL-4 and IL-10) cytokines) research methods. S. mutans count conducted using the methodology prescribed by Gold et al [Gold OG, Jordan H.V., van Houte J. A selection medium for streptococcus mutans. arches Oral biol. 1973;18 (11):1357-64.] .

To determine the level of cytokines, the oral fluid was taken on an empty stomach from 8.00 to 10.00 am, settled, centrifuged, and taken 0.5 ml into special tubes for each cytokine index separately, frozen, and stored in a freezer. After collecting all the samples, they were simultaneously thawed (separately for each set of reagents) and the level of cytokines was determined by enzyme-linked immunosorbent assay (ELISA). To assess the immune response, the index of the ratio of pro-inflammatory cytokines (FNO- α , IL-6) to anti-inflammatory cytokines (IL-4 and IL-10) (P/A) was calculated. Index P/A - reflects the ratio of pro- and anti-inflammatory cytokines.

The obtained data were statistically processed.

Research results. Studying the relationship between the state of hygiene and the social status of patients, we established the social status of the examined, of which 68.6±3.43% were employees, and 31.4±1.57% were workers. The state of oral hygiene was established, 74.4±3.73% brush their teeth daily 2 times a day, and 25.6±1.28% brush their teeth 1 time daily, respectively. Great importance was given to the presence of bad habits in the examined patients, since smoking affects the surface of teeth and restorations. It was found that 65.1±3.25% do not have a bad habit, and 34.9±1.74% do.



When determining the quality of fillings immediately after the restoration, we set the evaluation scores, which corresponded to positive results for all criteria. Charisma Average was 1.12 ± 0.06 Denfil N 1.10 ± 0.05 I - XCite LC N 1.11 ± 0.05 for Firuze Grand was equal to 1.12 ± 0.06 respectively. At the same time, restorations from domestic material were not inferior to their foreign counterparts.

The indicators changed in accordance with the dynamics, 6 months after the restoration, we found the average score for Charisma was 1.44 ± 0.07 , Denfil N 1.52 ± 0.07 I - XCite LC N 1.47 ± 0.07 for Firuze Grand was equal to 1.51 ± 0.07 respectively. At the same time, the Firuze filling had a high level of surface roughness (SR) Grand 1.62 ± 0.08 , Charisma had a high score after 6 months, belonged to the color match of the restoration - 1.52 ± 0.07 , Denfil N - the highest score was also according to the SCR criterion - 1.68 ± 0.08 . A similar trend was observed during the restoration of I - XCite LC N 1.62 ± 0.08 .

When determining the long-term results, namely, 12 months after the restoration, we have established the following indicators according to the evaluated Ruge criteria. Restorations with Firuze composite filling material Grand had similar performance relative to comparable nanohybrid composites. A high score was set according to the AF criterion - 1.86 ± 0.09 , which exceeds the indicators for the restoration with Charisma composite - 1.82 ± 0.09 . Composite I - XCite LC N 1.72 ± 0.09 respectively. The mean score for Charisma was 1.84 ± 0.09 ; Denfil N 1.92 ± 0.1 ; I - XCite LCN 1.77 ± 0.09 ; at Firuze Grand was equal to 1.81 ± 0.09 respectively.

In many scientific publications, special attention is paid to the role of *S. mutans* from all known streptococci of the Viridans group. The results of this stage showed that two representatives of this group, *S. mutans* and *S. sanguis*, were found in 100% of cases in two groups of patients. At the same time, it clearly demonstrates that the frequency of occurrence of the remaining representatives varied. In the course of our study, we settled on the definition of *St. mutans*, as it is an indicator pathogen for the development of demineralization sites. We have established the level of adhesion to the surface of the restoration of nanohybrid composites that were used. The level of adhesion was compared with the surface of intact teeth immediately after restoration, after 6 and after 12 months.

We have found that a sharp change in the level of adhesion *St. mutans* to the surface of nanohybrid composite restorations (CFU/ml) 6 months after restoration. A filling from Charisma has an index of *St. mutans* was 125.62 ± 6.3 (CFU/ml) versus 10.25 ± 0.51 in the control group; at Denfil N 165.31 ± 8.26 (CFU/ml) vs. 11.32 ± 0.56 (CFU/ml); restoration surface made of I-XCite LC N was 156.85 ± 7.84 (CFU/ml) versus 12.06 ± 0.60 ; and Firuze Grand 173.25 ± 8.66 (CFU/ml) versus 9.32 ± 0.46 (CFU/ml), respectively.

Similar results were obtained after 12 months. Adhesion *mutans* on the surface of nanohybrid composite restorations filling materials Charisma was 1033.25 ± 51.6 (CFU/ml) versus 20.42 ± 1.02 (CFU/ml) in the control group; at Denfil N 1246.03 ± 62.3 (CFU/ml) versus 22.33 ± 1.11 (CFU/ml); restoration surface made of I-XCite LC N was 985.21 ± 49.2 (CFU/ml) versus 19.46 ± 0.97 (CFU/ml); and Firuze Grand 1024.32 ± 51.2 (CFU/ml) versus 17.83 ± 0.89 (CFU/ml), respectively.

We studied pro-inflammatory cytokines - TNF- α and IL-6, since they are key, they signal through type I cytokine receptors, which are structurally different from other types. They are



critical for coordinating the cell-mediated immune response and play a critical role in the modulation of the immune system. Hyperproduction of anti-inflammatory cytokines such as IL-4 and IL-10 performs a protective and adaptive function, enhancing humoral immunity and inhibiting cell-mediated reactions [11].

The immunocytokine profile of the oral fluid was determined immediately, 6 and 12 months after the restoration of nanohybrid composite filling materials. The indicators immediately after filling in all groups showed similar data, with a significant increase in pro-inflammatory cytokines and a decrease in the level of anti-inflammatory cytokines IL-10 and IL-4 [2,11]. The values of TNF- α and IL-6 6 months after the restorations were 2 times higher than those immediately after restorations, similar values were for the values of anti-inflammatory cytokines IL-10 and IL-4, respectively.

Dynamics of anti-inflammatory cytokines in the oral fluid after 12 months with restorations from nanohybrid composites Charisma was 11.72 ± 0.6 (ng/mL) and 6.53 ± 0.3 (ng/mL) when TNF- α and IL-6 were 20.11 ± 1.0 and 10.11 ± 0.5 respectively. In patients where Denfil N was used indicators were 12.31 ± 0.61 and 7.44 ± 0.37 (ng/ml) versus 19.32 ± 0.97 and 9.65 ± 0.48 XCite LC N was 11.62 ± 0.58 and 6.95 ± 0.35 versus 22.51 ± 1.12 and 10.03 ± 0.50 , respectively. The level of IL-10 and IL-4 was 13.03 ± 0.65 and 5.81 ± 0.29 ; and pro-inflammatory cytokines TNF- α and IL-6 25.42 ± 1.27 and 8.51 ± 0.42 when using Firuze grand.

In a comparative assessment with indicators immediately after filling, the level of pro- and anti-inflammatory cytokines differed sharply with statistical significance. This further confirms that cytokines act as key messengers to and between immune cells and help maintain a delicate and complex balance in the immune system.

Cytokines affect almost all biological processes, such as the pathogenesis of diseases, non-specific response to infection, specific response to antigen. These changes once again prove the need to influence the immunological reactivity of the oral cavity in order to increase the timing and quality of restorations.

Conclusions and discussions. Clinical quality of restorations from domestic nanohybrid composite material Firuze grand has no significant differences from restorations made from materials of the same group, its application does not cause increased adhesion of *S. mutans* to the surface and does not lead to a significant violation of the cytokine profile of the oral fluid.

Grading the quality of composite restorations according to the level of risk and types of individual therapeutic and preventive measures, based on a differentiated level of risks of reducing the quality of restorations, can improve the long-term results of quality by more than 45.00%.

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