



INDIVIDUALIZED STRATEGIES FOR THE PREVENTION AND TREATMENT OF  
INFLAMMATORY PERIODONTAL DISEASES IN THE DYNAMICS OF CLINICAL  
OBSERVATION

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### Introduction

Modern dental prosthetics is characterized by the widespread use of digital technologies (CAD/CAM, additive manufacturing methods), which ensure high accuracy and aesthetics of prosthetic restorations. However, their long-term performance depends not only on the accuracy of fit but also on the physicochemical characteristics of the materials, including resistance to oral fluid exposure and biofilm formation. Microbial biofilm formation on the surface of prosthetic restorations is one of the leading pathogenetic factors of periodontal diseases and peri-implantitis. Surface wettability, surface free energy (SFE), and hydrophilicity of materials play a key role in this process.

### Objective

To comprehensively evaluate the physicochemical and hydrolytic properties of modern polymeric materials for prosthetic restorations manufactured with digital technologies under conditions of interaction with oral fluid.

### Materials and Methods

The study included 50 patients aged 20–40 years (equally distributed by gender). Oral fluid was collected in the morning according to standard methodology. The tested materials included 3D printing polymers ("DENTAL pink," "DENTAL peach," "DENTAL sand") and milling polymers ("PMMA," "PMMA pink"). Cubic specimens (15×15×15 mm) were fabricated and subjected to standard mechanical processing (grinding and polishing). They were then placed in a thermostatic chamber at 36.6±0.5 °C. Surface tension of a pendant drop (mJ/m<sup>2</sup>) was determined using the Young–Laplace method, and the static contact angle (°) was measured according to P.A. Rebinder. Surface free energy was calculated using the Owens–Wendt–Rabel–Kaelble method (1989). Measurements were performed with a DSA1.6-01 instrument (KRÜSS, Germany). Statistical analysis was carried out using Excel software and the Student's t-test at a significance level of p<0.05.

### Results

The highest surface free energy was observed in "DENTAL pink" (61.78±0.27 mN/m), which was statistically higher compared to "DENTAL peach" (57.05±0.23 mN/m, p<0.05), "DENTAL sand" (55.42±0.17 mN/m, p<0.05), "PMMA" (54.93±0.22 mN/m, p<0.05), and "PMMA pink" (53.39±0.24 mN/m, p<0.05).

Contact angle analysis demonstrated the lowest values in "DENTAL pink" ( $40.26 \pm 2.03^\circ$ ), indicating high washability and better surface hydrophilicity. Significantly higher values were recorded for other materials: "DENTAL peach" –  $47.08 \pm 1.69^\circ$  ( $p < 0.05$ ), "DENTAL sand" –  $49.3 \pm 2.8^\circ$  ( $p < 0.05$ ), "PMMA" –  $52.04 \pm 1.03^\circ$  ( $p < 0.05$ ), "PMMA pink" –  $53.39 \pm 0.24^\circ$  ( $p < 0.05$ ).

The mean surface tension of oral fluid in the study group was  $39.61 \pm 0.46$  mJ/m<sup>2</sup>, which corresponds to the literature data and confirms the accuracy of the measurements.

### Conclusions

Surface hydrophilicity and free surface energy determine material resistance and susceptibility to microbial colonization. *DENTAL pink* demonstrated the most favorable properties, making it a promising material for prosthetic restorations with minimal risk of biofilm formation.

A comprehensive evaluation of the physicochemical properties of polymers enables evidence-based material selection and the development of personalized preventive strategies to reduce the risk of periodontal inflammation and increase the longevity of restorations.

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