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**BIOLOGICAL EVALUATION OF COCR DENTAL ALLOY FOR SELECTIVE
LASER MELTING AND 3D PRINTING. A PILOT STUDY**

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Introduction: CAD/CAM technologies provide fast production of precise dental restorations. There are two main ways of making the metal copings when using digital methods – milling and 3D printing (selective laser melting (SLM)). Biocompatibility of PFM restorations depends on the ion emission from the metal infrastructure. Free Cobalt ions may cause allergic, cytotoxic, or even carcinogenic reactions in human body. Ion release from metal objects in the oral cavity may be a reason for symptoms of pathogalvanism.

The aim of the study is to evaluate the biological properties of a dental alloy 3D printing via SLM regarding the presence or absence of free Cobalt ions.

Materials and Methods: PFM crowns were produced for 18 patients using CAD/CAM technology. After taking digital impressions, the metal copings

were designed, and the files were sent to the 3D printer EOS M100, Germany, present at the CAD/CAM Center of FDM-Plovdiv for selective laser melting of the dental alloy. 3D printed resin models were used for completing the PFM restorations (Fig.1). 3D printed copings made of CoCr dental alloy EOS CobaltChrome SP2 (EOS, Finland) were tested for presence of free Cobalt ions using “Chemo Cobalt Test” (Chemotechnique Diagnostics, Sweden). Reaction between nitroso-R-salt and free cobalt leads to change in color of the cotton tip from white to reddish-brown. Copings were tested at several stages of production process – after 3D printing, after stress relieving, after preparation for porcelain firing and after restoration is completed. Additional testing was performed after stay of the copings in distilled water.



Fig.1. PFM crowns produced by CAD/CAM technology and SLM of the metal copings.

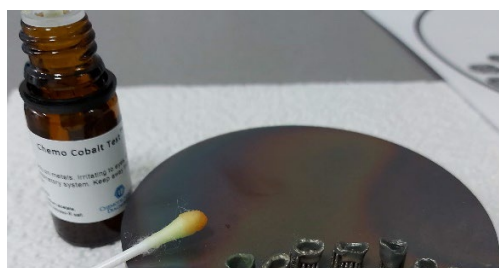


Fig. 2. Testing after 3D printing of the copings.



Fig. 3. Testing before porcelain firing.

Saliva samples from the patients were taken before, 2 hours and 7 days after fixing the crowns in the oral cavity. Open circuit potential measurements were conducted at the same intervals using apparatus Dentotest Six (Atlantis OOD, Bulgaria).

Results and Discussion: Copings tests were positive for free Cobalt ions at all stages during production of PFM restorations (Fig. 2,3). Negative reaction was found only at the copings after 3-day stay in distilled water (Fig.4). Results indicated that there is a risk of potentially harmful ion emission from the metal copings. The intensity of coloration may indicate the concentration of free Cobalt ions. An additional treatment of the copings may reduce the level of free Cobalt probably due to forming of stable oxide layer. Further investigations are needed. Saliva testing for Cobalt ions is planned using ICP-MS. A method for detecting isoprostanes in saliva as a marker of oxidative stress due to free metal ions is in

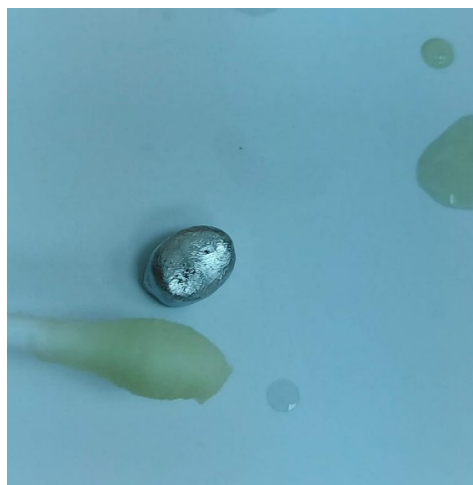


Fig. 4. Testing after stay in distilled water.

process of validation. Results of open circuit potential measurements are in statistical processing.

Conclusion: The presence of free Cobalt ions requires further studies on the biological properties of dental CoCr alloy for selective laser melting and 3D printing.

This pilot study was funded by Grant NO-01/2020 of Medical University-Plovdiv, BULGARIA.

Abstract: Free metal ions from dental alloys may cause allergic, cytotoxic or pathogalvanic reactions. The presence of free cobalt ions is tested by a quantitative reaction. Saliva samples are taken for checking the presence of metal ions and isoprostanes. Open circuit potential measurements are conducted before and after fixing the PFM crowns produced by SLM and 3D printing.

Key words: base dental alloys, SLM, free Cobalt ions.

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ИНФОРМИРОВАННОСТЬ НАСЕЛЕНИЯ В ВОПРОСАХ ФАКТОРОВ РИСКА, ПРОФИЛАКТИКИ СЕРДЕЧНО-СОСУДИСТЫХ ЗАБОЛЕВАНИЙ



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Актуальность. Анализ литературных данных позволяет сделать вывод, что распространенность сердечно-сосудистых заболеваний (ССЗ) колеблет-

ся в различных пределах в зависимости от страны, и даже регионов отдельной страны [1,2,5,8,9,10]. Несмотря на проводимые государственные про-