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Effect of cold atmospheric plasma application on nano-TiN coated Co-Cr dental alloy

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Since Co-Cr alloy is the most widely used base material for constructing dental prosthesis, many different efforts have been provided to enhance their surface energy and wettability with various surface modification procedures. Adhesion capability and surface activation of restorative materials remain as a goal for reliable clinical performance of dental restorations. Durable and strong adhesive bonding between the frameworks or between different materials in the structure of prosthesis is necessary to withstand the varied challenges in the oral environment. The acceptable bond strength depends on the wettability between the adhered surfaces and adhesive, which is necessary to ensure adhesion. Wetting is the first condition for providing adhesion. Titanium nitride (TiN) is a member of the refractory transition metal nitrides family which exhibits properties characteristic of both covalent and metallic compounds. TiN has many advantages such as including intrinsic biocompatibility, sufficient corrosion resistance, reduction of bacteria, and its suitability for use in patients who have a metal allergy to vanadium, nickel and cobalt. TiN is also a suitable material for the hard coating of various dental materials and dental surgical instruments in order to improve their surface properties. In particular, the TiN coating that provides a diffusion barrier and biocompatible surface has been applied using a metal sputtering technique in order to fabricate biocompatible prostheses. Seven Co-Cr discs were machined and smoothed with silicon polishing discs. The RF sputtering system was used for the depositions of TiN. An RF power supply of 13.56 MHz was used. Mechanical polishing was performed to reduce the surface roughness. The samples were cleaned in 96% ethanol and distilled water. The dental samples were coated with a thickness of 100 nm TiN. The surface roughness was evaluated in a control group and in groups with different plasma-jet exposure application times (30-60-120 seconds). Kinpen 09 plasma jet was used in this study. The distance between nozzle and sample surface was approximately 5 mm. Argon gas was used as carrier gas at a flow of 5l/min at 2.5 bar pressure. The average surface roughness (Ra) and contact angle (CA) measurements were recorded via an atomic force microscope (AFM) and tensiometer, respectively. According to the results with an increase in the application time, an apparent increment was observed for Ra and a remarkable reduction in CA was observed in all groups. It is concluded that the argon plasma-jet technology could enhance the roughening and wetting performance of Co-Cr dental material.

Biography

Emre Seker completed his PhD at Ankara University and Near East University respectively. He is a Lecturer and Clinical Specialist at Eskisehir Osmangazi University, Department of Prosthodontics. He has published more than 30 papers and presentations and continues to study on “Surface treatment techniques of dental materials, CADCAM implant dentistry and plasma technology”.

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