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Aluminum in dental implants: how to reduce a potential risk to patient´s health?

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Abstract: Some commercial dental implants contain aluminum, which represents a potential risk to health, since aluminum is associated with neurodegenerative diseases like Alzheimer's disease. Therefore, control of chemical composition as well as surface characteristics of implants is necessary, and one approach is functionalization of implant's surface by bio(organic) molecules. Hydrolyzed collagen molecules were self-assembled on the titanium implant containing aluminum. Density Functional Theory calculation results indicated an exergonic reaction (ΔG^*_{INT} = -6.45 kcal mol^{-1}) between implant surface and chosen hydrolyzed collagen molecules, while electrochemical impedance spectroscopy results pointed to improved anti-corrosion properties of the modified implant surface (protective effectiveness, η = 98.5 %) compared to the unmodified implant surface. During immersion in an artificial saliva (7 days), the hydrolyzed collagen-modified implant remained stable what is crucial for minimizing possible negative biological effects on patient's health.

Keywords: titanium dental implant; aluminum; surface functionalization; EIS; DFT; anti-corrosion properties