

Soda-Lime Glass-nAg Biocide Coating on Titanium alloy and Ceramic oxide Substrates for Dental Implants

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Infections occurring after dental implant surgery very often cannot be treated with commercially available antibiotic-loaded bone cement, as such treatment requires higher doses of antibiotics. Peri-implantitis is a common biological complication in implant therapy and a main cause of implant failure [1]. The presence of a submarginal biofilm induces a periimplant inflammatory reaction which results in a breakdown of soft and mineralized tissues surrounding endosseous implants [2]. Findings from experiments in the dog and the monkey have demonstrated that submarginal plaque formation induced by ligature placement results in peri-implant tissue breakdown [3]. An alternative approach to prevent implant infection described in this work is based on the use of a soda-lime glass coating containing silver nanoparticles [4-6]. Silver is a nontoxic metal to the human tissue. It has been used in humans for centuries with the advantage that contrary to antibiotics, microorganisms do not develop resistance against silver. In the present investigation a mechanically stable soda-lime glass coating containing silver nanoparticles (2.6 to 20 wt%) on Ti-6Al-4V, alumina and zirconia substrates have been developed. Optimum firing conditions have been determined to fabricate the different coatings with good adhesion to the substrates. The biocide activity of these coatings was also investigated. Coatings containing 20 wt% of silver nanoparticles exhibited excellent biocide activity ($\log \eta > 5$) versus Gram+, Gram-bacteria as well as yeast after 24h. It has also been proved that this coating inhibits the formation of biofilm. Finally in a "in vivo" test using 5 beagle dogs, Ti-6Al-4V implant abutments coated with a soda-lime glass containing 20wt% silver nanoparticles were subjected to experimental periimplantitis. The bone loss observed in implants dressed with a biocide coated abutment was about 3 times lower than the control ones. From these results it is evident that the soda-lime glass-nAg coatings emerge as a promising approach to prevent peri-implantitis.

References

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