AAID 2011 Annual Meeting – 3rd Place – Table Clinic

New Anti-Microbial Peptide Coating for Dental Implants

Rachana Hegde, BDS, Graduate Student; K.V. HOLMBERG, M. ABDOLHOSSEINI, S.U. GORR, and C.J. APARICIO

Objectives: Peri-mucositis and peri-implantitis are the two major complications of implant therapy that affect its short and long term success. Peri-implantitis is an inflammatory response to bacterial infection resulting in bone loss and implant failure. Antimicrobial-peptide GL13K, derived from Parotid Secretory Protein, has been shown to have bactericidal and bacteriostatic properties. This work aims to fabricate a biofunctionalized Ti-surface by covalently-anchoring the potentially antimicrobial GL13K-peptide.

Methods: Commercially-pure Ti discs were polished, cleaned, chemically-activated by etching in NaOH, silanized with 3-chloropropyltriethoxysilane (CPTES), and functionalized with GL13K. Thermochemical and mechanical stability were assessed by immersion in PBS (37°C, 5-8days) and ultrasonication in de-ionized water for 2h, respectively. Surfaces were physicochemically characterized by advancing water contact-angle, infrared spectroscopy (IR), and x-ray photoelectron spectroscopy (XPS). P. gingivalis was grown on tested surfaces under anaerobic conditions. After 5 and 7 days, cell number was quantified by measuring ATP content and CFUs. ANOVA-tables ($p<0.05$) with post-hoc test were used to determine statistically significant differences between groups.

Results: Ti discs were successfully biofunctionalized with antimicrobial-peptide GL13K via covalent anchoring and physisorption. Wettability significantly decreased with water contact angles from 15° to 125° ($n=3$, p-value<0.0001) after coating surfaces with GL13K, implying presence of peptide on the surface. Confirmatory tests with IR and XPS showed signal from the peptide on coated samples. Coatings were thermochemically and mechanically stable after ultrasonication. This is of particular clinical relevance for an easy implant handling during surgery and durability of the coatings both before and after implantation. In a preliminary experiment, GL13K-coated etched-Ti-surfaces showed reduced P. gingivalis biofilm formation compared to control surfaces.

Conclusions: The biofunctionalized Ti with a mechanical and thermochemical stable coating of GL13K-peptides constitutes a candidate for anti-bacterial dental implants and abutments Supported by a 3M Non-tenured Faculty Award (CA), UMN-SOD Summer Fellowship Program (KVH), and R01DE017989 from the National Institute for Dental and Craniofacial Research (SUG). Parts of this work were carried out in the Characterization Facility, University of Minnesota, which receives partial support from NSF through the MRSEC program.