Presented at the British Society for Oral and Dental Research meeting 2013

Chlorhexidine-hexametaphosphate nanoparticles as antimicrobial coatings for dental implants

Natalie J. Wood, Howard F. Jenkinson, Dominic J. O'Sullivan, Sean A. Davis, Michele E. Barbour

School of Oral and Dental Sciences, University of Bristol, Bristol BS1 2LY.

Titanium is the major component of many dental implant systems due to its biocompatibility and ability to osseointegrate. However, dental implants are susceptible to bacterial colonisation. Chlorhexidine is a broad spectrum antimicrobial agent used extensively in dentistry to prevent and treat infection. By anchoring it to an implant surface, an antimicrobial effect can be administered locally and at the site of bacterial adhesion. Nanoparticles have the advantage that implant coverage is tuneable and it is possible to ensure that most of the titanium is available for osseointegration.

Objectives: The aim of this investigation was to apply novel antimicrobial nanoparticles formulated from chlorhexidine and hexametaphosphate (CHX-HMP) as a coating for dental implants.

Methods:

CHX-HMP nanoparticles were precipitated upon the addition of aqueous chlorhexidine digluconate solution (10 mM) to an aqueous solution of sodium hexametaphosphate (10 mM), under constant stirring. Commercially pure grade II titanium substrates were immersed in the rapidly stirred colloidal nanoparticle suspension for 30s and then rinsed by immersion in deionised water for 10s and dried.

Nanoparticle size and surface distribution were investigated using Dynamic Light Scattering (DLS), Atomic Force Microscopy (AFM) and Scanning Electron Microscopy (SEM). The antimicrobial efficacy of these surfaces against *Streptococcus gordonii* was investigated.

Results:

The CHX-HMP nanoparticles adhered readily to titanium forming aggregates in discrete regions, surrounded by uncoated titanium (AFM, SEM). Adhesion and proliferation of the ubiquitous oral bacterium *S. gordonii* were significantly reduced within 24 h by the presence of the CHX-HMP nanoparticles.

Conclusion:

CHX-HMP nanoparticles adhered to clinically relevant titanium substrates. The nanofunctionalised surfaces effectively inhibited adhesion and proliferation of *S. gordonii* suggesting the potential of this system for dental implant surface coatings.