TECHNOLOGY

Dental Nanocomposites and Bonding Agents with Antibacterial Properties

OVERVIEW

The major clinical problem associated with dental restorations is secondary cary formation and tooth restoration fractures. To address this issue, a new dental resin developed at the University of Maryland, Baltimore, was created to possess superior mechanical strength and antimicrobial properties. The formulation consists of inorganic nanoparticles and resins that impede the formation of caries by neutralizing cariogenic pH values, inhibiting the growth of acidogenic, tooth-demineralizing bacteria such as *S. mutans* and remineralizing the tooth enamel by enhancing calcium and phosphate release in response to increased acidity.

Dr. Huakun Xu and his team at the University of Maryland, Dental School, have developed a dental resin formulation that incorporates quaternary ammonium dimethacrylate (QADM), nanoparticles of silver (NAg) andamorphous calcium phosphate (NACP) to impede the formation of caries. The inventors have shown that the patent protected formulation decreased the titer counts of adherent Streptococcus mutans biofilms by an order of magnitude, compared to commercial composites. In situ studies conducted with human volunteers demonstrated that the formulation substantially reduces caries formation compared to control composite. Additional studies are ongoing with antibacterial bonding agents, including primer and adhesive that can help combat recurrent caries at the tooth-composite margins.

APPLICATIONS

An estimated 200 million dental restorations are placed each year in the United States, amounting to an annual cost of several billion dollars. Of the many dental restorations performed, caries at the restoration margins remain the primary reason for failure, and half of completed restorations need replacement within ten years. Dental caries remains one of the most prevalent and preventable chronic diseases in the United States. Worldwide dental caries exists in 60-90% of children and almost 100% of adults.

ADVANTAGES

- Displays antibacterial properties against the cariogenic bacterium S. mutans that are not observed in commercial controls
- Has unique property of enhancing calcium and phosphate release in response to increased acidity to neutralize cariogenic pH
- Can be used in conjunction with fluoride-releasing dentifrices and mouth rinses to enhance caries inhibition and remineralization efficacy
- Strength comparable to existing commercial composites

STAGE OF DEVELOPMENT

- Early demonstration of dental Cary reduction in humans

R&D REQUIRED

Advanced development as new dental products offering improved solutions.

(As of 6/8/2017) - MEW

LICENSING POTENTIAL

UMB seeks partners for licensing, clinical development, and/or sponsored research to advance this technology into the healthcare field.

CONTACT INFO

Office of Technology Transfer
620 W Lexington St., 4th Floor
Baltimore, MD 21201
Email: ott@umaryland.edu
Phone: (410) 706-2380

Additional Information

INSTITUTION

University of Maryland, Baltimore

PATENT STATUS

HX-2010-042: US patent 8,889,196, EU patent application 11 801 397.8 HX-2012-066: US patent 9,554,971 issued 01/31/2017, CON 9,937,104 issued 04/10/2018, EU patent application 13 746 175.2 f HX-2010-042: US patent 8,889,196 issued 11/18/2014, EU patent application 11 801 397.8 filed 12/30/2012

LICENSE STATUS

Available for licensing; Available for sponsored research

CATEGORIES

- Dental

INVESTIGATOR(S)

Huakun Xu
Michael Weir

ATTACHMENTS

- Download HX-2010-042 HX-2012-066 Technology Summary - final.docx

EXTERNAL RESOURCES

- Antibacterial amorphous calcium phosphate nanocomposites...(Cheng et al. 2012)
- Novel calcium phosphate nanocomposite with caries-inhibition in a human in situ model (Melo et al., 2013)
- Dental primer and adhesive containing a new antibacterial quaternary ammonium monomer...(Cheng et al., 2013)
- Effect of quaternary ammonium and silver nanoparticle-containing adhesives on...strength and biofilms (Zhang et al., 2012)

HX-2010-042 & HX-2012-066