# Dental Nanocomposites and Bonding Agents with Antibacterial Properties

Summary

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.

Market

Key Investigator

Huakun Xu

Michael Weir

Field

dental

Technology

Dental restoration

antimicrobial composite

Technology Status

Early demonstration of dental Cary reduction in humans

Status

Available for licensing and/or sponsored research

Patent Status

**HX-2010-042:** US patent 8,889,196 issued 11/18/14, EU patent application 11 801 397.8 filed 12/30/12

**HX-2012-066:** US patent 9,554,971 issued 1/31/17, CIP 15/399,869 filed 1/6/17, EU patent application 13 746 175.2 filed 9/5/14

UMB Docket Reference

HX-2010-042, HX 2012-066

References

* [Melo et al. 2013.](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3561736/pdf/nihms421489.pdf)
* [Cheng et al. 2012.](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3322309/pdf/nihms-350779.pdf)
* [Moreau et al. 2011.](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3375606/pdf/nihms-380806.pdf)
* [Xu et al. 2011.](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3125490/pdf/nihms291163.pdf)
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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.

Technology

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.

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