

Designing smarter dental materials to fight dental caries

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The global epidemic of tooth decay affects more than 90% of the world's population. Tooth decay so called dental caries is a multifactorial disease in which the fermentation of sugars from daily diet by dental plaque leads to localised demineralisation of tooth surfaces, which may ultimately result in cavity formation. Dental caries at the margins of restorations has been the main reason for restoration failure. The replacement of the failed restorations accounts for 50-70% of all tooth cavity restorations performed. The development of recurrent caries at the tooth-restoration margins is a primary reason for composite restoration failures. Dental restorative materials such as composites, glass ionomer cements, and adhesive systems are being widely used; however, they still have several drawbacks. These dental materials are in contact with tooth and can be the ideal vehicle for delivering anticaries agents. Nanotechnology has been applied to develop the next generation of dental restorative materials with desirable bioactive properties, to not only replace the missing tooth volume, but also exert therapeutic effects to combat caries. Nanoparticles of silver (NAg) and nanoparticles of amorphous calcium phosphate (NACP) were introduced into restorative materials to achieve antimicrobial and remineralizing properties, respectively. Another strategy to combat caries lesions around restorations is the incorporation of antibacterial monomers in the dental material composition. The antibacterial, remineralizing and mechanical properties of these new materials indicate that novel nano-sized agents can fight bacteria and reduce the demineralization in restored tooth cavities. This lecture summarizes the ongoing advances expressed by a set of studies from our research group considering mechanical properties, antibacterial activity and biocompatibility of emerging functionalized nanoparticles as strategies for addressing dental restorative challenges. This includes new nanomaterials with potent antibacterial activity as well as remineralization capability, the combination of several bioactive agents together in resin for effective caries inhibition, and their promising in vitro properties and in vivo performance.

Biography:

Dr. Mary Anne Melo is an assistant professor at the Operative Dentistry Division/Department of Endodontics, Prosthodontics and Operative Dentistry at University of Maryland School of Dentistry. Dr. Melo's research focuses on interactions between oral biofilms and dental biomaterials with an emphasis on developing novel strategies to reduce the initiation and progression of dental caries adjacent to existing restorations (recurrent caries). Her work involves studies for development of novel dental and bioactive materials that have functionalities for caries-inhibiting, antibacterial, or remineralization. These materials include dental composites, nanocomposites, sealants, bonding agents, cements, etc. Dr. Melo is a current member of the Academy of Operative Dentistry; the International Association for Dental Research; the Society for Color and Appearance in Dentistry, and American Academy of Cosmetic Dentistry. Dr. Melo has published over 40 research articles and serves as reviewer for several journals in Dentistry, Medicine and Biomaterials.