conferenceseries.com

Diane R Bienek, J Material Sci Eng 2017, 6:9 (Suppl)
DOI: 10.4172/2169-0022-C1-084

2nd International Conference and Exhibition on

POLYMER CHEMISTRY

November 15-17, 2017 | San Antonio, USA

Diane R Bienek

ADA Foundation, USA

Multifunctional polymeric materials for dental restorations

Statement of the Problem: Polymeric resin-based materials are commonly used in dental restorations. A trend for the next generation is to incorporate multifunctional capabilities to regulate microbial growth and re-mineralize tooth surfaces. Our ongoing, NIDCR-supported research (DE026122) focuses on simultaneous incorporation of novel quaternary ammonium antimicrobial acrylic co-monomer (QA-MA) and bioactive amorphous calcium phosphate (ACP) filler into urethane-based (UDMA) resins. While a sustained release of re-mineralizing calcium (Ca) and phosphate (P) ions is a desired feature in restoratives, the potential leaching of unreacted monomers and other products can lead to clinical failure. We assessed Ca and P ion release (remineralization potential) of ACP filler and *in vitro* cytotoxicity of QA-MA in gingival cells.

Methodology: ACP and Bis(2-methacryloyloxy-ethyl) dimethyl-ammonium bromide (IDMA) were synthesized and their structure confirmed by Fourier transform infrared (FTIR) spectroscopy, X-ray diffraction analysis (XRD) and/or 1H-nuclear magnetic resonance spectroscopy (1H-NMR). Ion release studies employed inductively coupled plasma-atomic emission spectroscopy (ICP-AES). Direct contact cytotoxicity tests were performed per ISO10993-5. Gingival fibroblasts (HGF) and keratinocytes (Gie-No3B11) were exposed to two-fold serial dilutions of IDMA (≤1.6 µmol) and methacrylic acid (≤12 mM) as a degradation product. After 24 and 72 h, cells were assessed for viability and metabolic activity.

Findings: The ACP filler and IDMA were successfully synthesized and characterized by XRD/FTIR/ICP-AES and FTIR/NMR, respectively. A desired remineralization potential of ACP fillers has been achieved: supersaturated solutions with Ca/P of 1.66 are conducive to tooth mineral re-deposition (Fig. 1). IDMA concentration did not exert a significant effect on HGF viability or metabolic activity (Fig. 2). However, an effect ($P<0.001$) of time was observed on metabolic activity (~20% lower after 72 h).

Conclusion & Significance: ACP and IDMA were successfully synthesized. Bio-testing prior to comprehensive physicochemical and mechanical evaluations ensures that the QA-MA's potential cytotoxicity is carefully balanced with the antibacterial activity.

Biography

Diane R Bienek has 15+ years of experience conducting translational science in the Biomedical and Dental field. A primary focus has been to establish applied research and product development studies designed to improve patient care by advancing point-of-care technologies for mitigating and treating post-operative complications. At the ADA Foundation, Volpe Research Center, she is part of an interdisciplinary team for the advancement of bioactive polymeric materials. To ensure biocompatibility of novel antimicrobial dental materials, her recent efforts include conducting *in vitro* toxicological assessments on eukaryotic cell types associated with the oral cavity.

bienekd@ada.org

Notes: