



Research Week 2022

Effect of quaternary ammonium methacrylate composite and acquired salivary pellicle on surface charge density and biofilm growth

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Keywords

antimicrobial materials, resin composite, *S. mutans*, biofilm

Abstract

The efficacy of any antibacterial coating depends on their ability to directly contact the microorganisms they seek to eliminate. In the oral cavity, all surfaces are almost immediately coated with a layer of proteins known as the acquired salivary pellicle (ASP) once in contact with saliva. In this study, the antibacterial efficacy of a quaternary ammonium methacrylate (QAM) was tested in the presence of ASP, in terms of surface charge density and overall *S. mutans* elimination.

One commercial composite (Filtek Supreme, 3M-ESPE) and experimental methacrylate composites with 0 (control) or 10 wt% quaternary ammonium methacrylate (QAM-C16), containing photoinitiators and 70 wt% of inorganic fillers were used to fabricate discs (10 mm Ø and 1.5 mm thickness, n=6), light-cured for 40 s. Saliva was obtained from donors who abstained from brushing teeth for 24 hours or have food/drink intake 2 hours prior to collection. Saliva was processed cold, and sterilized, and used to produce ASP on disc surface (1 mL, 2 hours). Discs were then transferred to 24-well plates containing aliquots (1 mL) of bacterium TH medium (10 µL Bioluminescent *S. mutans*) at a 5% CO₂ incubator for 24 h. Bioluminescence activity and surface charge density were measured in a microplate reader (SuperMax D3).

Results indicated significant reduction on the biofilm growth for QAM composite regardless of the presence of an ASP compared to the control groups (Figure 1). Higher surface charge density ($p < 0.0001$) was observed for QAM composites compared to other groups (Figure 2). Presence of an ASP reduce the surface charge density for QAM ($p < 0.005$).

Conclusions: The presence of acquired salivary pellicle did not interfere with the antibacterial efficacy of a quaternary ammonium monomer.

Funding: NIH-NIDCR R35-DE029083

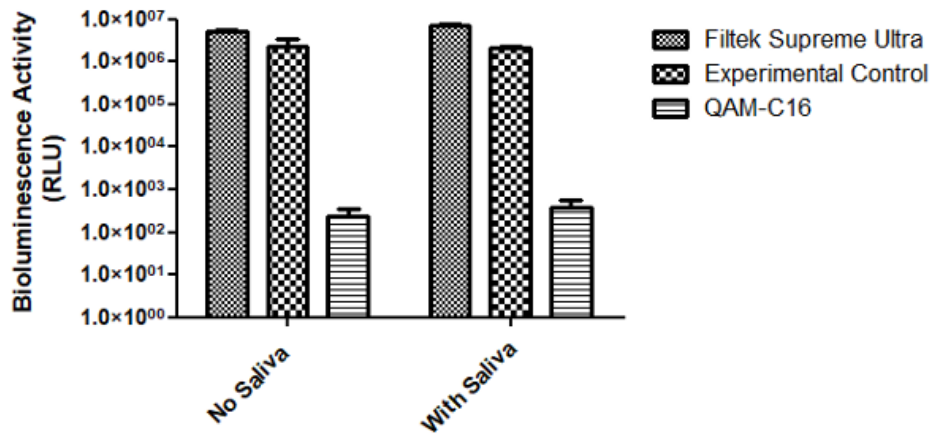


Figure 1. Plots of bacterial bioluminescence activity measured by Luciferase Assay and expressed in Relative Light unit (RLU) after 24 hours of biofilm Growth. Differences higher than two rows in magnitude indicate biological significance.

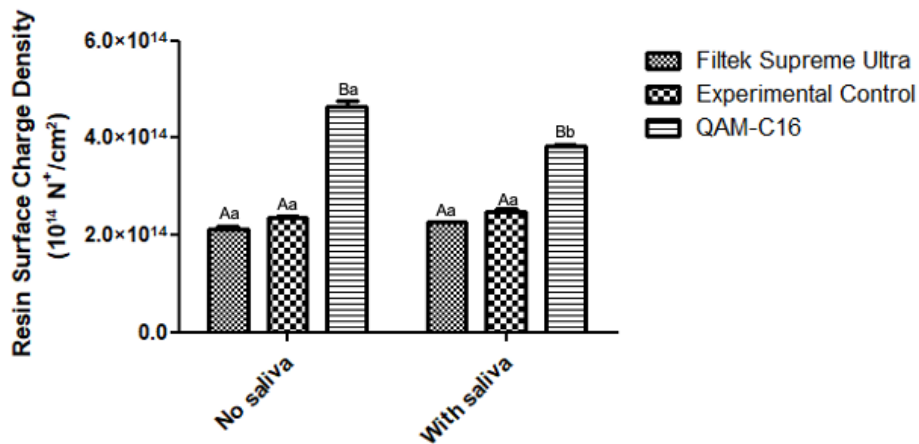


Figure 2. Plots of the resin surface charge density ($10^{14} N^+/cm^2$) assessed by Fluorescein Assay (absorbance measured at 501 nm) with (2 hours of acquired saliva pellicle acquisition) or without saliva. Different uppercase letters indicate significant differences among compositives. Different lowercase letters indicate significant differences for the same compositives.