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Tailoring material surface chemistry to control acquired pellicle composition.

Fernanda Midori Tsuzuki[1], Lucena FS[2], Lewis S[3], Pfeifer CS[4]

[1,2,3,4]Biomaterials and Biomechanics, School of Dentistry, Oregon Health and Science University (OHSU), Portland, OR, USA

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Abstract

Introduction

The acquired salivary pellicle (AP) modulates the composition of the oral biofilm adhered to oral structures. The aim of this study was to investigate how the surface chemistry of polymeric materials influence the composition of the AP and the biofilm formed.

Methods

BISEMA and PEGDMA (100/0; 50/50; 0/100 wt%) were used to make discs polymerized at 740 mW/cm2 (1 min each side) and then treated with human saliva for 2h. Proteins were extracted with gel electrophoresis and proteomic profiles obtained with mass spectrometry. The surface chemistry was characterized by contact angle (WCA) and mid-IR (ATR, also used to obtain degree of conversion - DC). The viability of S.mutans biofilms was evaluated by bioluminescence (Luciferase Assay) and Crystal Violet (CV) with our without AP present. Data were analyzed by two-way-ANOVA/Tukey's test (α=0.05).

Results

DC was statistically similar for all materials ($p=0.789$). WCA ranged from 74.5±1.9 to 47.6±2.9, for BisEMA and PEGDMA, respectively ($p<0.001$, Figure 1-A). The more hydrophilic materials showed greater concentration of -OH (3400cm-1) and Amide-I (1650cm-1) peaks (Figure-1B). The proteomic analysis identified more than 415 proteins. Alpha-amylase-1B was very abundant in 50/50BISPEG and PEGDMA, while Desmoglein-1 was very abundant in BisEMA (Figure-1C). The presence of AP had an influence on the results of biofilm viability ($p<0.001$) and biomass ($p=0.007$). Also, the different materials showed significant differences in biofilm biomass ($p<0.001$, Figure-1A). While preliminary, these results demonstrate that even relatively subtle differences in polymer composition can affect the proteomic profile and biofilm adherence. This proof-of-concept will be utilized to design surfaces that can ultimately tailor the ecology of the biofilm on surfaces in the oral cavity.

Conclusion

The results demonstrate that the polymer surface chemistry influences the proteomic composition of the AP.

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