Efficient Bacteria Killing by Dental Adhesives with Benzyldimethyldodecylammonium Chloride

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Statement of Purpose: Bacterial infiltration at the resin-dentin bonding triggers the premature failure of adhesive tooth restorations. A series of drugs or materials, including antibiotics, metal ions, can inhibit bacteria growth and destroy the cellular structure of oral pathogens. However, it is known that the above materials are associated with concerns about antibiotic resistance, environmental pollution, complex chemical synthesis, and high cost. Herein, a dental adhesive was conveyed with antibacterial property using quaternary ammonium compound presenting hydrocarbon chain length of 12 and chloride as halide ion, Benzyldimethyldodecylammonium Chloride BAC_{12}. **Title:** Efficient Bacteria Killing by Dental Adhesives with Benzyldimethyldodecylammonium Chloride **Materials & Methods:** BAC_{12} and all other reagents were used as received without any further purification. At first, The minimum inhibitory concentration and the minimum inhibitory bactericidal concentration of the BDMDAC were investigated. Then, parental dental adhesive was formulated combining two methacrylate monomers: 66.66 wt.% of bisphenol A glycerolate dimethacrylate (BisGMA) and 33.33 wt.% of 2-hydroxyethyl methacrylate (HEMA). As photoinitiator/co-initiator system, camphorquinone, and ethyl 4-dimethylaminobenzoate. Experimental groups were modified to contain multiple concentrations of BAC_{12} (1%, 2%, 3%, 4%, and 5 wt.%). Samples (n=6) were subjected to an S. mutans biofilm model. Colony-forming unit (CFU) assay, metabolic activity, and live/dead imaging were performed. The data were analyzed using one-way analysis of variance (ANOVA) and Tukey tests.

Results: The CFU counts for S. mutans biofilms adherent on the new dental adhesives containing BAC_{12} at 4 and 5% were reduced to about 70%–75% of the CFU of biofilms on the control ($p< 0.001$). In addition, the metabolic activities were reduced significantly at similar concentrations ($p>0.001$), with more dead/compromised colonies in the live/dead images than the other groups.

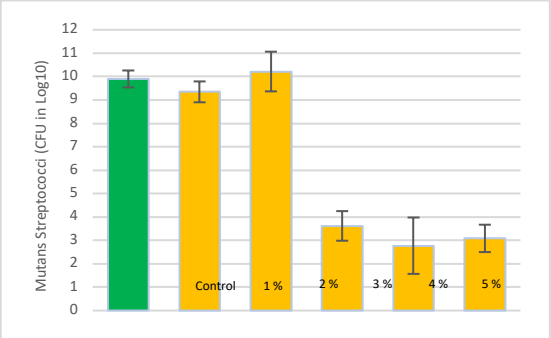

Figure 1. Colony-forming unit counts for mutans streptococci on resin composite disks.

Conclusions: In summary, an antibacterial dental adhesive combining benzyldimethyldodecylammonium chloride was designed. All the formulated dental adhesives demonstrated robust biofilm inhibition. Metabolic activities and biofilm visualization by LIVE/DEAD assay supported this study's antibiofilm effect of the antibacterial adhesives outcome. Our results indicate that dental adhesives containing benzyldimethyldodecylammonium chloride (BAC_{12}) have potential use for prevent bacterial infiltratino at the bonding interface of teeth restored with bonded restorations.

References:

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