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Preparation of a novel antibacterial resin system for improved dental restorative

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Background: Secondary caries is found to be the main reason to the restoration failure of dental restoratives. Secondary caries that often occurs at the interface between the restoration and the cavity preparation is primarily caused by demineralization of tooth structure due to invasion of plaque bacteria (acid-producing bacteria) such as Streptococcus mutans (S. mutans) in the presence of fermentable carbohydrates. To make long-lasting restorations, the materials should be made antibacterial.

Objective: The objective of this study was to synthesize new quaternary ammonium salt-containing oligomers, incorporate them to dental resin composites, and evaluate the effects of these new oligomers on the mechanical strength and antibacterial activity of the formed composites.

Methods: The antibacterial oligomers were synthesized, characterized and incorporated into the resin composite. Compressive strength and S. mutans (an oral bacteria strain) viability were used to evaluate the mechanical strength and antibacterial activity of the formed experimental composites. The effects of the substitute chain length on the synthesized antibacterial oligomers, different oligomers, oligomer loading, and aging on strength and S. mutans viability of the composites were evaluated.

Results: The results show that all the quaternary ammonium salt-modified resin composites showed significant antibacterial activity. Increasing chain length and loading significantly enhanced the antibacterial activity but also reduced the strength. The 30-day water-aging study showed that water did not reduce the antibacterial activity of the composite, implying that the antibacterial quaternary ammonium salt is not leachable. On the other hand, the incorporation of quaternary ammonium salt reduced the strength of the composite, suggesting that the quaternary ammonium salt loading should be well controlled so as not to compromise the mechanical strength of the composite.

Biography

Dong Xie is currently Associate Professor at Department of Biomedical Engineering, Purdue School of Engineering and Technology, Indiana University-Purdue University at Indianapolis. He obtained Ph. D. degree from The Ohio State University, School of Dentistry.

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