OPTIMIZING LIGHT-CURED COMPOSITE PROPERTIES WITH CAMPHROQUINONE AND BUTYLHYDROXYTOLUENE COMBINATIONS

Hani M. Nassar and (Tien-Min G. Chu), School of Dentistry, Indiana University, Indianapolis, Indiana 46202

Polymerization shrinkage is an inherent property in dental composite that has major effects on its clinical performance. Many strategies on minimizing the shrinkage have been explored in the past. Here we propose that, by optimizing the dose combinations of photoinitiator and polymerization inhibitor, we can effectively reduce the polymerization shrinkage stress without sacrificing the mechanical properties of dental composite. The objective of this study therefore was to investigate the effects of a common photoinitiator, camphroquinone (CQ), and inhibitor, butylhydroxytoluene (BHT), at clinically-relevant concentration combinations on the shrinkage properties and mechanical properties of light-cured composite. Samples were prepared by mixing bisphenol-A-glycidyl methacrylate, urethane dimethacrylate, and tetraethyleneglycol dimethacrylate at a 1:1:1 ratio. Borosilicate glass fillers constituted 70% of the resin weight. Sixteen groups of resin composite were prepared from the combination of four CQ (0.1%, 0.5%, 1.0%, and 1.5%) and four BHT (0.0%, 0.5%, 1.0%, and 1.5%) levels. Six properties were tested, including Flexural strength (FS) flexural modulus (FM), degree of conversion (DC), contraction stress (CS), stress rate (SR), and gel point (GP). The effects of CQ and BHT combinations on each of these properties were evaluated using two-way analysis of variance (ANOVA). Groups with low CQ and BHT showed moderate values for FS, FM, SR and CS with DC around 70%. Increasing the BHT concentration caused a decrease in SR, CS, DC and an increase in GP values. Increasing the CQ content gave a steady increase in values for FS and FM. Notable, in CQ=1.5% group, increasing BHT from 0 to 1.5% result in a statistically significant decrease in polymerization shrinkage stress ($p<0.05$) while maintain the same mechanical properties. In this project, we successfully demonstrated that the polymerization shrinkage of resin composite can be tailored through CQ and BHT combinations with high CQ and high BHT showing the most promising results.

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