Thiol-Ene-Methacrylates as Dental Restorative Materials

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Thiol-ene systems demonstrate numerous advantageous polymerization properties in regards to rapid curing, high conversion, minimal oxygen inhibition, and reduced shrinkage stress¹. However, one of the drawbacks of thiol-ene systems is that commercially available monomers are not able to achieve the mechanical properties required for use as dental restorative materials². Methacrylate systems on the other hand, exhibit excellent polymer mechanical properties for applications such as dental restorative materials, but exhibit low conversion and high shrinkage stress limiting performance and longevity¹. The combination of methacrylate and thiol-ene systems uniquely results in a synergistic combination of the advantages of both systems decreasing the effects of oxygen inhibition, increasing conversion and biocompatibility, and decreasing polymerization shrinkage stress³. Additionally, it is demonstrated that when utilized as highly filled composite systems, the mechanical properties of thiol-ene-methacrylate systems are further improved.

This study examines properties of thiol-ene-methacrylate systems that are relevant to the evaluation of dental restorative materials. Specifically, the polymerization kinetics, flexural modulus and strength, and shrinkage stress were evaluated for thiol-ene-methacrylate resins cured with a visible light initiating system. Due to their improved overall functional group conversion and reduced water sorption, the methacrylate-thiol-ene formulations are expected to exhibit improved biocompatibility relative to the dimethacrylate control systems. Improvements in flexural strength and reduced shrinkage stress are expected to result in composite restorations with superior longevity and performance.

