0819 Thermal Effects on Composite Photopolymerization Monitored by Real-time NIR

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Objectives: This study was designed to apply a near-infrared spectroscopic technique to define the effect of modest external heating on the photopolymerization of composite restorative materials. Methods: NIR spectra were collected at high temporal resolution to monitor disappearance of the methacrylate overtone absorption at 6164 cm-1 as composite specimens were irradiated at room temperature or 54.5 ºC. Three commercial composite restorative materials (Filtek, Herculite and SureFil) were photocured using three commercial curing units: quartz halogen (QHL75), light emitting diode (Elipar Freelight) and plasma arc light (ADT 1000). The immediate conversion and final conversion after post-cure were analyzed for each material, light and temperature combination. In addition, the time to reach 98% of the maximum conversion during room temperature polymerizations was compared with the time required to achieve this same conversion value at elevated curing temperature. Results: Significantly higher conversion values were found for Herculite compared with either Surefil or Filtek ($p < 0.05$). Over all materials and irradiation sources, the immediate conversion results obtained at 54.5 °C were increased between 11 and 21 % over corresponding room temperature values. Final post-cure conversion values for heated polymerizations were between 6 and 18 % larger than those derived from ambient cures. Generally, significant post-cure conversion gains were observed for ambient temperature polymerizations while no significant post-cure resulted at elevated cure temperatures. The higher cure rates obtained at elevated temperature are evident in the time differential to reach equivalent conversion with room temperature and heated polymerizations, which ranged from a 51 % reduction for the Filtek/plasma arc light combination to a 92 % reduction for the SureFil/LED combination. Conclusion: Dynamic NIR provides a versatile method to analyze the photopolymerization process in dental composites. Photocuring composites at elevated temperatures can result in significantly increased conversion values and dramatically increased polymerization rates. Supported by AdDent

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