0602 Pre-heated Resin Composite. Temperature Effects on Monomer Conversion and Kinetics

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Objectives: The influence of pre-polymerization temperature and exposure duration on monomer conversion and polymerization kinetics of a commercial photo-activated composite is studied. Methods: The temperature-controlled stage of a diamond-attenuated-total reflectance unit was used to pre-heat composite (Esthet•X/Dentsply-Caulk, shade A2) between 3^{o} and 60^{o}C. Composite was exposed using a conventional quartz-tungsten-halogen curing unit (Optilux 501/Demetron-Kerr) for 5, 10, 20 (control), or 40s. Real-time monomer conversion, maximum conversion rate, time into exposure when maximum rate occurred, and conversion at maximum rate were calculated from infrared spectra at both 0mm (top) and 2mm depths. Data were analyzed using regression, Student's t-tests, and ANOVA with appropriate post-hoc tests (alpha = 0.05). Results: A strong, positive correlation existed between temperature and conversion: top:r^2=0.999, 2mm:r^2=0.998. Conversion ranged from 31.6 to 67.3% (3 and 60^{o}C, respectively). Exposure duration could be reduced by 50 to 75% using pre-heated composite and achieve equivalent or higher conversion than control. Temperature significantly affected maximum cure rate: range 3.7%/s (3^{o}C, 2mm) to 24.2%/s (60^{o}C, top surface). All pre-heated conditions exhibited equal or greater conversion, maximal rate, and conversion at maximum rate as control (22^{o}C, 20s). Time when maximum conversion rate occurred was not affected by temperature. Exposure duration did not influence kinetic parameters at the top surface, but did reduce both maximum conversion rate and conversion at maximum rate 2mm deep when using shorter exposures.

Conclusions: Pre-warming composite prior to polymerization results in greater conversion, requires shorter exposure duration, and enhances maximal rate of conversion without changing the time into the exposure when the maximum rate occurs. Conversion at maximum cure rate increases with temperature, thus allowing more of reaction to occur prior the gel-point than at room temperature. Supported in part by CAPES (grant 03/48031) and AdDent Inc.

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