Laser acoustic emission thermal technique (LAETT): a technique for generating acoustic emission in dental composites.

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Abstract

OBJECTIVES: This study was designed to investigate a new method for generating interfacial debonding between the resin matrix and filler particles of dental composites. METHODS: A pilot study was conducted to evaluate laser-induced acoustic emission in dental resins filled with varying quantities of particles. Model systems of 50/50 BisGMA/TEGDMA resin reinforced with 0, 25, and 75 wt% 5-10 micrometers silanated BaSiO(6) were analyzed. The sample size was 3.5 mm diameter x 0.25-0.28 mm thick. A continuous wave CO2 laser (Synrad Infrared Gas Laser Model 48-1) was used to heat the composite samples. Acoustic events were detected, recorded and processed by a model 4610 Smart Acoustic Monitor (SAM) with a 1220A preamp (Physical Acoustic Corp.) as a function of laser power. RESULTS: Initially, the acoustic signal from the model composites produced a burst pattern characteristic of fracturing, about 3.7 watts laser power. Acoustic emission increased with laser power up to about 6 watts. At laser powers above 6 watts, the acoustic emission remained constant. The amount of acoustic emission followed the trend: unfilled resin > composite with 25 wt% BaSiO(6) > composite with 75 wt% BaSiO(6). SIGNIFICANCE: Acoustic emission generated by laser thermal heating is dependent on the weight percent of filler particles in the composite and the amount of laser power. For this reason, laser thermal acoustic emission might be useful as a nondestructive form of analysis of dental composites.