Laser-induced acoustic emissions in experimental dental composites.

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Abstract

A laser thermoacoustic technique was innovated to evaluate laser-induced acoustic emissions (AEs) in experimental dental composites aged with 75% ethanol solution. Experimental composite systems of 75/25 BisGMA/TEGDMA resin filled with 0, 12.6, 30.0, and 56.5 vol% of 8-microm silanized and unsilanized BaSiO6 were analyzed. The sample size was 4.65 mm (diameter) x 0.5 mm (thick). Aging effects of immersing in 75% ethanol for up to 14 h on AEs were then evaluated. A continuous-wave CO2 laser was used to heat the samples. Acoustic emissions were collected as a function of filler fraction, laser power, silanization, and immersion time. Onset of burst-pattern acoustic signals characteristic of fracturing occurred at different laser powers for different tested groups. Acoustic emissions generally increased with laser power, in which lower laser powers produced low-amplitude (45-50 dB) signals; the amplitude distribution (50-85 dB) became more extensive as laser powers increased. After immersion, the lower laser powers could produce the same phenomenon. The higher the filler fraction, the fewer AEs generated. A large percentage AE reduction due to silanization was noted as a function of filler fraction. Unsilanized specimens showed more thermal damages than did silanized ones.