Shrinkage behaviour of flowable resin-composites related to conversion and filler-fraction

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Abstract:

OBJECTIVES: To evaluate the shrinkage-strain, degree of conversion (DC) and percent filler of a range of flowable resin-composites.

METHODS: Several commercially available flowable resin-composites were selected. The bonded-disk technique was used to measure shrinkage-strain kinetics. Measurements were obtained continuously for 60min by irradiation for 40s at 750mW/cm(2) at two initial temperatures of 23 and 37 degrees C. Three repetitions (n=3) were made at each temperature per material. The DC was measured by FTIR spectroscopy immediately post-cure. The percent filler was determined by combustion of specimens for 1h at 400 degrees C.

RESULTS: The final values of shrinkage-strain ranged from 2.61 to 6.25% at 23 degrees C and from 3.88 to 6.56% at 37 degrees C. Statistically significant differences ($p<0.05$) were found in shrinkage-strain between the flowable resin-composites at both temperatures 23 and 37 degrees C. Significantly higher values were obtained at 37 degrees C ($p<0.05$). A strong inverse correlation was found between the percent filler and the shrinkage-strain at 37 and 23 degrees C ($r(2)=0.94$ and 0.87, respectively). No correlation was found between shrinkage-strain and DC ($p>0.05$).

CONCLUSIONS: Flowable resin-composites vary widely in shrinkage-strain magnitude and the inverse relationship between filler percent and shrinkage-strain is explained by the corresponding decrease in volume fraction of monomers present to undergo polymerisation.