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A study of polymerization shrinkage of composite resins cured by various light intensities

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I. Objectives

The purpose of this study was to compare the effect of exponential curing method with conventional curing and two step soft start curing method on polymerization shrinkage of composite resins.

II. Material and methods

Three brands of composite resins (Synergy Duo Shade, Z-250, Supreme) and three brands of light curing units (Spectrum 800, Elipar Highlight, Elipar Trilight) were used. In this study, the diameter of specimen was 5.5mm and height 1.6mm and the specimen was cured for 40 seconds. The shrinkage was measured by custom made linometer. The amount of linear polymerization shrinkage recorded in the computer every 0.5 second for 90 seconds. Each group was measured 10 times.

The effect of time on contraction shrinkage was analysed by one-way ANOVA and 95% Scheffe test and also the time when there was no further change of the contraction shrinkage was analysed. The effect of curing mode and material on contraction shrinkage at the time of 90 seconds was analysed by two-way ANOVA and 95% Scheffe test. The shrinkage ratios at the time of 20s and 90s were taken and analysed the same way.

III. Results

1. All the groups except Supreme contracted almost within 20 seconds. Supreme cured by soft start and exponential curing had no further change of contraction shrinkage from 30 seconds.
2. Statistical analysis revealed that contraction shrinkage varied among materials ($p<0.01$) and curing modes ($p<0.05$). There was no significant interaction between material and curing mode to linear shrinkage.
3. The groups cured by exponential curing showed the statistically lower contraction shrinkage at 90 seconds than the groups cured by conventional curing and soft start curing.
4. The initial shrinkage ratios of soft start and exponential curing were statistically lower than conventional curing.

IV. Conclusions

The conclusion from this study is that the use of low initial light densities may reduce the polymerization rate and then reduce the stress of polymerization shrinkage.