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Effect of pre-heating on the shear bond strength and microhardness of composite resin

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I. Objectives

The purpose of this study was to examine the effect of pre-heating on the shear bond strength and microhardness and degree of conversion of composite resin.

II. Materials & Methods

Eighty extracted, noncarious human molars stored in isotonic saline at 4℃ were used in the present study. Two coats of adhesive system (One-Step, Bisco, Schaumburg, IL, USA) were applied on tooth surfaces, and light cured for 15 seconds. For shear bond strength test, 4℃, 17℃, and pre-heated to 48℃, 56℃ composite resin were used. A composite resin was packed into the mold and light cured for 40 seconds. After 24 hours of water storage, the specimens in each group were tested in shear mode using a chisel-shaped rod in an Instron testing machine at a cross-head speed of 1 ㎜/min. For the microhardness measurements, four different temperatures of composite resin were used as above. Vickers microhardness was measured using Microhardness Tester FM™. Then, for 300 seconds, temperature change was examined with K-type thermocouple. Degree of conversions of each resin group was measured with FT-IR. The data for each group were subjected to one-way ANOVAs followed by the Tukey' s HSD test at 95% confidence level to make comparisons among the groups.

III. Results

Higher temperature of pre-heated composite resin yielded higher shear bond strength. In both enamel and dentin groups, pre-heated to 56℃ composite resin group yielded the highest shear bond strength. Higher temperature of pre-heated composite resin yielded higher microhardness value. Among the groups, pre-heated to 56℃ composite resin group yielded the highest microhardness value. For temperature change, pre-heated to 56℃ composite resin showed slow decline of temperature, and temperature above 48℃ was maintained for the first 60 seconds. Higher temperature of pre-heated composite resin yielded higher degree of conversion.

Increased polymerization temperature increases conversion of resin monomer, but only up to a certain temperature limit.

IV. Conclusion

Pre-heating composite resin has potential benefits including higher shear bond strength and microhardness value and degree of conversion.