Effect of Shade, Increment Thickness and Light Curing Distance on Dentin Bond Strength, Degree of Conversion and Cytotoxic Behavior of Resin Composite Core Build-Up Material

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BY

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I wish to dedicate this work to

My Great Parents,

My Always Supporting Wife,

My Lovely Daughters,

and My little Baby Boy.

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Since the chemists produced composite materials in their laboratories, they have been increasingly applied in dental field. Resin composite restorative materials represent one of the many successes of modern biomaterials research, as they replace biological tissues in both appearance and function. At least half of the posterior direct restoration placements now rely on composite materials.[1] Unfortunately, demands on these restorations with regard to mechanical properties, placement and need for *in-situ* curing leave significant room for advancements, particularly with respect to their mechanical properties, polymerization-induced stresses, thermal expansion mismatch, fracture, abrasion and wear resistance, marginal leakage, and toxicity.[2] Ultimately, these shortcomings reduce a restoration's lifetime and represent the driving force for improvement in dental composites.

Chemical-cured resin composites were introduced firstly and due to their drawbacks, light-cured resin composites were introduced afterwards. Light-cured resin composites have largely superseded the use of chemical-cured ones in aesthetic applications. They offer distinct advantages of improved storage stability, extended working time, increased degree of conversion, reduced air porosities caused by mixing and enhanced physical properties.[3] However, light-polymerizable materials need sufficient light energy to be transmitted through the material in order to initiate polymerization reaction and to reach the recommended degree of conversion (DC).[4] When applying light-cured resin composite material into deep cavities, its adequate polymerization is a crucial factor to ensure optimal bond strength at the resin-dentin interface, as well as ensuring optimal physical and biological properties. Many previous studies demonstrated incomplete polymerization of purely light-activated resin composites due to attenuation of the light energy by the restorative material and the distance from light curing source. The degree of this light attenuation is primarily dependent on the light curing distance, shade and thickness of the restorative material.[5]

In an effort to overcome the limitations of light-polymerized resin composites, there is a trend towards the use of the dual-polymerized ones for restorations thicker than 2 mm.[6] Dual-cured resin composites were introduced to ensure proper DC. However the situation in the clinical field is more complicated due to various intraoperative difficulties. These variables include the design and size of the light guide, distance of the light guide tip from the resin composite material, power density, exposure duration, shade and opacity of the resin composite, increment thickness as well as material composition.[7]

Core build-up resin composite being dual-cured, encourages its usage as a foundation restoration for both vital and endodontically treated teeth. Many manufacturers recommend placing the resin composite in more than a 2-mm-increment thickness yet maintaining acceptable DC. Dual-cured resin composites showed lower mechanical and biological properties when their curing is performed via chemical mode only.[4,7] Bond strength testing is one of the most important points of view for researchers