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Research paper

Static and dynamic moduli of posterior dental resin composites under compressive loading

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ABSTRACT

Dental resin composites are commonly used as restorative materials for dental treatment. To comprehend the static and dynamic moduli of dental resin composites, we investigated the mechanical behaviors of resin composites under static and dynamic loading conditions. Four commercially available resin composites for posterior restorations were evaluated. The percentages, by weight, of inorganic fillers of resin composites were examined by the ashing technique. The static compressive tests were undertaken with a constant loading speed of 1.0 mm/min using a computer-controlled INSTRON testing machine. The dynamic properties of composites were determined using the split Hopkinson pressure bar (SHPB) technique. When inorganic filler content was increased, a remarkable increase in the static modulus and dynamic modulus were observed. Furthermore, there was a strong relationship between the static modulus and dynamic modulus ($r^2 = 0.947$). The SHPB technique clearly demonstrated the dynamic properties of composites, and was a useful technique for determining the mechanical behavior of composites under dynamic compressive loading.

1. Introduction

Dental resin composites have been commonly used as restorative materials for dental treatment because they exhibit the appropriate physical and mechanical properties, as well as excellent aesthetic properties. Nowadays, the use of resin composites has been extended from anterior teeth to posterior teeth. In particular, posterior class-I or class-II restorations require composites that show high mechanical properties, whereas anterior restorations need composites that have superior aesthetic properties.

A dental resin composite is a dispersion-strengthened composite material composed of silica glass and dimethacrylate. To enhance the chemical bonding between the silica and matrix resin, the silica glass is treated with a silane coupling agent, which has a methacryloyl group at its ter-

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