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Mechanical and Thermal Properties of Hydroxyapatite-Impregnated Bone Cement

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Abstract: Self-curing acrylic cements, consisting mainly of polymethylmethacrylate (PMMA), are widely used in dentistry and orthopedic surgery. One of the major side effects of the standard PMMA application is tissue necrosis at the bone-cement interface due to the rise of temperature during the polymerization reaction. This may also lead to aseptic loosening over time. Therefore, intense research is being carried out in the development of bone cements with new compositions. In this study, the aim was to develop new bone cement compositions that would have low setting temperature and high mechanical strength and be comparable with the commercially available ones. For this purpose, PMMA bone cements having various amounts of hydroxyapatite were prepared. In order to obtain a proper and homogeneous distribution of hydroxyapatite particles within the cement, very low-viscosity PMMA bone-cement compositions were developed. The addition of hydroxyapatite decreased the polymerization temperature (from 111 ^{o}C to 87 ^{o}C) and increased the compressive strength (from 110 MPa to 122 MPa) of the resultant cements. These new bone cements have setting temperatures and mechanical strengths comparable with commercially available cements and are believed to be more biocompatible since hydroxyapatite is a natural mineral present in the bone structure.

Key Words: PMMA, bone cement, biomechanics, hydroxyapatite, biocompatible

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