

Machinable Glass-Ceramics as a Dental Material

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The aim of this research was to develop a mica-based glass-ceramic for restorative dental materials according to Dentistry-Ceramic materials ISO 6872: 2015. The glass system of SiO₂-Al₂O₃-MgO-MgF₂-SrCO₃-CaCO₃-CaF₂ and P₂O₅ was prepared with 4.0 mol% fluorapatite called GCF4.0. The glass compositions were melted in 1 h. at 1450°C. with heating rate of 10°C/min and then the molten glass was quenched into the water to become glass frits. The obtained frits were crushed by a high-speed milling in alumina bowl, then sieved for <45 µm frits. Consequently, the pigments (metal oxides) were added into the glass frit and then homogeneously milled. It was remelted and poured into the carbon mould at high temperature approximately 1450 °C, after that kept to annealing temperature 580°C (T_m-50°C) and cooled to room temperature to obtain a glass rod. Then, the heat treatment of the GCF4.0 glass was processed to the nucleation and crystallization, respectively, to transform to a glass-ceramic. The GCF4.0 glass-ceramic presented biaxial flexural strength (210 MPa), fracture toughness (2.04 MPa•√m) and chemical solubility (~380 µg•cm⁻²) values, which were suitable to use as single-unit anterior or posterior prostheses for dental restorations according to ISO 6872:2015. However, the heat treatment time affected to crystal sizes and spatial distribution; the longer heat treatment time, the smaller crystals. However, the translucency parameters (TP) of the resultant glass-ceramics were affected by short heat treatment time for better translucency. The values of the properties were comparable to those of human enamel and suitable for some restorative dental applications.