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Effects of incorporation of hydroxyapatite and fluoroapatite nanobioceramics into conventional glass ionomer cements (GIC)

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Abstract

Hydroxyapatite (HA) has excellent biological behavior, and its composition and crystal structure are similar to the apatite in the human dental structure and skeletal system; a number of researchers have attempted to evaluate the effect of the addition of HA powders to restorative dental materials. In this study, nanohydroxy and fluoroapatite were synthesized using an ethanol based sol-gel technique. The synthesized nanoceramic particles were incorporated into commercial glass ionomer powder (Fuji II GC) and were characterized using Fourier transform infrared and Raman spectroscopy, X-ray diffraction and scanning electron microscopy. Compressive, diametral tensile and biaxial flexural strengths of the modified glass ionomer cements were evaluated. The effect of nanohydroxyapatite and fluoroapatite on the bond strength of glass ionomer cement to dentin was also investigated. Results showed that after ١ and ٧ days of setting, the nanohydroxyapatite/fluoroapatite added cements exhibited higher compressive strength (١٧٧-١٧٩ MPa), higher diametral tensile strength (١٩-٢٠ MPa) and higher biaxial flexural strength (٢٦-٢٨ MPa) as compared with the control group (١٦٠ MPa in CS, ١٤ MPa in DTS and ١٨ MPa in biaxial flexural strength). The experimental cements also exhibited higher bond strength to dentin after ٧ and ٣٠ days of storage in distilled water. It was concluded that glass ionomer cements containing nanobioceramics are promising restorative dental materials with both improved mechanical properties and improved bond strength to dentin. © ٢٠٠٧ Acta Materialia Inc.

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Author keywords

Glass ionomer cement; Mechanical properties; Nanofluoroapatite; Nanohydroxyapatie; Sol-gel synthesis

Indexed Keywords

EMTREE drug terms: alcohol; apatite; fluorapatite; glass ionomer; hydroxyapatite; water

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MeSH: Apatites; Biomechanics; Durapatite; Glass Ionomer Cements; Materials Testing; Microscopy, Electron, Scanning; Nanostructures; Nanotechnology; Spectroscopy, Fourier Transform Infrared; Surface Properties; X-Ray Diffraction
Medline is the source for the MeSH terms of this document.

Chemicals and CAS Registry Numbers: alcohol, ٦٤-١٧-٥; apatite, ٦٤٤٧٦-٣٨-٦; fluorapatite, ١٢٥٢٥-٤٠-٥, ١٣٠٦-٠٥-٤, ٥٨٠٥١-٨٢-٤; hydroxyapatite, ١٣٠٦-٠٦-٥, ٥١١٩٨-٩٤-٨; water, ٧٧٣٢-١٨-٥;Apatites; Durapatite, ١٣٠٦-٠٦-٥; fluorapatite, ١٣٠٦-٠٥-٤; Glass Ionomer Cements