Glass Poly-Vinyl-Phosphonate Cements with Reactive Aluminium Hydroxide Coated Sub-micron Anatase Filler

Paul Alexander Brookbank

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I certify that all material in this thesis which is not my own work has been identified and that no material has previously been submitted and approved for the award of a degree by this or any other University

(Paul Alexander Brookbank)

Abstract

The current generation of Glass Ionomer Cements (GICs) have many advantageous properties over other dental restorative materials but lack the compressive strength of these other materials. The aim of this project is to increase the compressive strength of conventional Glass Poly-Vinyl-Phosphonate cement by inclusion of reactive sub-micron filler particles.

The setting characteristics, chemical reactivity and cement strength have been found using oscillating rheology, infrared spectrometry, nuclear magnetic spectrometry, transmission electron microscopy, potentiometer analysis, laser diffractometry and mechanical analysis.

The addition of sub-micron filler particles in direct weight by weight replacement of aluminosilicate glass of a control material has increased the ultimate compressive strength of the new cement from 206MPa (control) to 250MPa after 365 days of aging. The strength of the new filler enhanced cements were comparable with the control material after 3 hours. The setting chemistry of the filler enhanced cements follows the same order as the control cement but at a decelerated rate.

Theoretical modelling found that a large volume of sub-micron filler could fit into interstitial spacing in formed cement however the alteration of the aluminosilicate glass to polyelectrolyte ratio has been found to drastically alter the cement setting time.
The use of cubic and polyhedral shaped filler particles as supposed to spherical particles may increase the cement strength further as greater packing densities are achieved.

The formulation of a Glass Ionomer Cement with increased compressive strength may find use as a posterior restorative or as a better material for restoration of lesions and cavity liners.

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