Compressive Aging Response of Nano-particle Reinforced Dental Cements

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Abstract
A variety of cements have been used in dentistry for luting cast dental restorations on natural teeth. Their properties are immediately related to their chemistry and composition. Many chemical types are nowadays available in the dental market. Variations in composition may affect some of the properties. Purpose: Purpose of the present study was to investigate the influence of different additives concentrations in the compressive strength of five commercially available dental luting cements. Self-prepared nanoparticles of Hydroxyapatite and a commercially available nano-clay (Montmorillonite, Cloisite 15A) were incorporated in five types of commercially available dental luting cements (five groups) in order to improve their compressive strength after setting in air and after saliva aging. Two concentrations of the above mentioned additives were studied, 2 and 5% wt. respectively. A total of 250 specimens were fabricated for all combinations of cements and additives' concentrations, five for every tested subgroup. Half of them were tested 24h after setting and the rest after isothermal aging for 50d in artificial saliva at 37 ^{o}C. Cylindrical specimens were subjected to compressive loading up to their final fragmentation at a crosshead speed of 1.5 mm/min. Hydroxyapatite had a beneficial effect on zinc phosphate cement. The same trends were exhibited for the specimens with Montmorillonite additive, but at a lower extent. Both Hydroxyapatite and Montmorillonite additives improved spectacular stiffness and strength of zinc oxide-eugenol cements. Little or negative effect was observed for zinc polycarboxylate cement when hydroxyapatite additive was used, while excellent results were obtained in compressive strength when montmorillonite additive was used. Both nano-additives had an overall negative effect on the compressive properties of the glass ionomer cements. Both nano-additives had little impact on the compressive moduli of the related nanocomposite specimens. Yield and ultimate strength were improved when 2 %wt concentration of additive was used.

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