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Editorial Open Access

Incorporation of Hydroxyapatite-Silica Nano-Powder for Enhancement of Glass Ionomer Cement (GIC)

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Editorial

Glass Ionomer Cement (GIC) is one of the most popular materials among the available dental restorative materials. They have desirable properties like direct adhesion to the tooth structure, thermal compatibility [1] and good biocompatibility [2,3]. Despite these advantages, brittleness, low tensile and flexural strengths have limited their use only to certain low stress-bearing sites. As such, the incorporation of micron-range sized particles, such as alumina, zirconia or glass fibers into CGICs are some of the many efforts made to improve the mechanical strength of CGIC [4-6]. Nevertheless, it did not significantly improve its mechanical strength.

Hydroxyapatite is a naturally occurring mineral form of calcium. These days, nanohydroxyapatite has been used as filler in some of dental biomaterials to improve its properties. Improvements in their compressive strength, diametral tensile strength [7], flexural strength [8], toughness, bonding and fluoride-release properties [9] have been reported after the addition of HA into the material. In particular, a few studies have been conducted in School of Dental Sciences, Universiti Sains Malaysia (USM) to improve the hardness of CGIC. In this case, nano-hydroxyapatite-silica (HA-SiO_2) was synthesized by one pot technique [10] and incorporated into commercially available CGIC Fuji IX GP (GC International, Japan). It was found that the addition of nano-HA-silica into CGIC (HA-SiO_2-GIC) increased the hardness of CGIC by 73% compared to the use of conventional GIC alone [10]. It is believed that the nano silica particles fill the voids between the hexagonal HA particles, and subsequently enhance the packing density, thus increase its hardness [10]. This belief is supported by the Transmission Electron Microscope (TEM) and Scanning Electron Microscope (SEM) micrographs which showed good distribution of the elongated HA and spherical silica within the specimen, with both of them were in nano-sized particles [11]. Results of magic angle spinning nuclear magnetic resonance (NAS NMR) clearly showed the presence of high degree of cross linking between the silica and GIC. This cross linking is believed to play a significant contribution in making the HA-SiO_2-GIC much stronger in hardness, compared to CGIC [11].

Within the limitation of these studies, the investigations on HA-SiO_2-GIC demonstrated some favourable results. Among these include the higher mechanical strength reported of HA-SiO_2-GIC, compared to conventional GIC. Thus, HA-SiO_2-GIC holds a promise to be used as a potential restorative material particularly on higher stress bearing area such as on posterior teeth. However, further in vitro and in vivo investigation is required to validate the potential use of this material in clinical dentistry.

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