# Silver nanocomposite materials as antimicrobial agents for dental application

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Glass ionomer cements (GICs) are fluoride-releasing restorative materials used for a wide range of applications in dentistry, but in particular as a filling material for the treatment of caries. While claims of anti-cariogenic properties are often made with respect to GICs due to the (temporary) release of fluoride, numerous studies have revealed that the fluoride release is insufficient to inhibit bacterial biofilm formation, which often leads to recurrence of the infection. As a result, there is an evident need for improved GICs with inherent, lasting antibacterial activity. Our team has developed a silver nanoparticle formulation prepared through the use of microemulsion techniques that can be added to a range of existing commercially available GICs, resulting in a material that can prevent microbial biofilm formation on the surface of GICs, in contrast to the non-modified materials (Figure 1). The silver nanoparticles were specifically functionalised to enable them to participate in ionic cross-linking within the cement, which we believe to be advantageous in terms of the mechanical properties of the material, which will be discussed. Furthermore, due to the chemical bonding of the surface-modified silver nanoparticles within the GIC, no silver leaching from the cement has been detected, offering the potential for ongoing antimicrobial effect at the GIC surface while minimising systemic toxicity concerns. Regardless, the toxicity of our silver nanoparticle formulation has been evaluated against human gingival fibroblast cells and determined to be non-cytotoxic at very low silver concentrations, but above that required to impart antibiofilm effects to GICs. The results of our toxicity study will be presented, and compared with those obtained for clinically relevant silver-containing caries treatments.

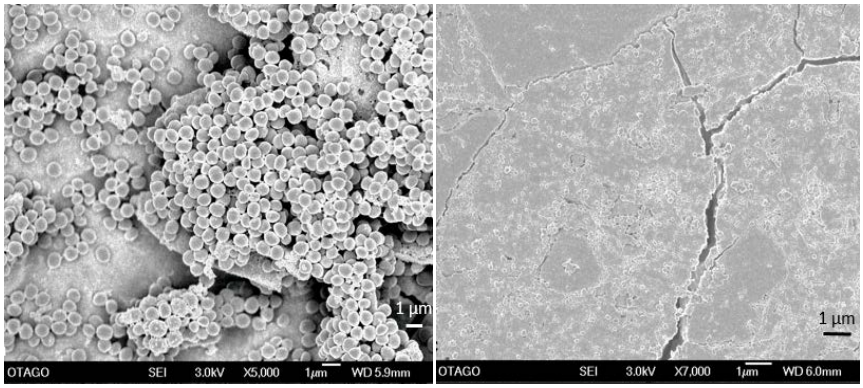


***Figure 1:*** SEM images comparing biofilm development of *Streptococcus sanguis* on the surface of an unmodified GIC manufactured by GC Corporation, Japan (left), and a silver nanoparticle-modified GIC (right).