Applications of bioactive glasses for glass ionomer cements

Altair T. Contreras Jaimes*[1], Gloria Kirste[1], Roland Wetzel[1], and Delia S. Brauer†[1]

[1]Otto Schott Institute of Materials Research, Friedrich Schiller University – Jena, Germany

Abstract

Glass ionomer cements (GICs) are materials traditionally used in dentistry for filling and luting purposes. However, applications extend to their use for bone applications owing to advantages such as a low exothermic reaction when setting and ability to bond to bone.
Dental GICs are formed by a neutralisation reaction between a fluoro aluminosilicate glass and an acid such as poly (acrylic acid) (PAA). This reaction occurs when the glass is degraded by the acid, allowing the release of ions such as calcium and aluminium that crosslink with the carboxylate (COO-) groups from the acid, resulting in a matrix of polyacrylate-based salts and embedded glass particles. The final composite is biocompatible; however, their surface is relatively inert owing to the reduced degradation of the glass after the cement is set, which is translated into a low release of ionic species of biological interest for the formation of a bioactive layer as a precursor of bone formation. By contrast, bioactive glasses based on the SiO2-Na2O-CaO-P2O5 system described by Hench, are known for their osteinductive and osteoconductive properties derived from the ability of the glass to degrade and release silicon, calcium and phosphate ions. In addition, other ions that function as network modifiers (e.g. Sr2+) can be substituted in the glass structure and released when the glass is exposed to a media such as simulated body fluid (SBF). Therefore, the use of bioactive glasses has been of special interest as an additive of GICs, since their degradability have the potential to improve the formation of a calcium phosphate layer on their surface, as previously described by Yli Urpo *et al.* (2005). Here, we present results of bioactive glass-based GICs including their setting time, chemistry and mechanical properties. FTIR-ATR was used to characterise the setting of cements through the change of the characteristic bands over time.

References

Yli-Urpo H., Lassila, L, Närhi, T & Vallittu, P. 2005. Compressive strength and surface characterization of glass ionomer cements modified by particles of bioactive glass. Dental Materials., 21, 201-209.

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*Speaker
†Corresponding author: delia.brauer@uni-jena.de