Fluoride ion diffusion from a glass-ionomer cement.

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Abstract

The aims of this study were to observe the release of fluoride ions (F-) from GC-Fuji Lining-LC(R) glass-ionomer cement, to assess the diffusion process, and to measure fluoride diffusivity (D) in the set cement. Specimens of various dimensions and shapes, ranging from discs to cylindrical rods, were fabricated for both open and embedded modes of testing. In the open mode studies, specimens with different surface to volume ratios were selected and immersed in 37 degrees C distilled water. In the embedded mode studies, only one diametral surface of the rod-shaped specimens of different lengths and diameters was exposed. F- concentration was measured using a fluoride electrode. The storage solution was analysed at predetermined intervals hourly, daily, and weekly (up to 10 weeks). Immediately after each sampling, the old storage solution was discarded and replaced with new distilled water. F- release from the set cements was detectable (0.4-3.8 ppm, varied with sample geometry), even after a 10-week sampling interval. F- release was greater in ground set cements (0.37 ppm/mg powder) than in control samples of unmixed powder (0.01 ppm/mg powder) immersed for 1 h. Two mechanisms for F- release were proposed. One was short-term and involved rapid dissolution from the cement surface. The other was more gradual and resulted in the sustained diffusion of ions through the bulk cement, which can be modelled by applying a mathematical technique known as separation of variables to Fick's Second Law of Diffusion. The mean D of F- in embedded set cements of glass-ionomer was (1.4+/-0.5)x10-11 cm2/s, with higher apparent D observed in open mode samples [(7.6+/-1.4)x10-11 cm2/s].