Bioactive coatings on Portland cement substrates: Surface precipitation of apatite-like crystals

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Abstract

We report a method for depositing bioactive coatings onto cement materials for bone tissue engineering applications. White Portland cement substrates were hydrated under a 20% CO\(_2\) atmosphere, allowing the formation of CaCO\(_3\). The substrates were incubated in a calcium phosphate solution for 1, 3, and 6 days (CPI, CPII, and CPIII respectively) at 37°C to induce the formation of carbonated apatite. Cement controls were prepared and hydrated with and without CO\(_2\) atmosphere (C+ and C\textendash\textendash respectively). The presence of apatite-like crystals was verified by Scanning Electron Microscopy (SEM) and Energy Dispersive Spectroscopy (EDS). The substrate cytocompatibility was evaluated via SEM after 24 hour cell cultures. SEM revealed the presence Ca(OH)\(_2\) on C\textendash\textendash, and CaCO\(_3\) on C+. Apatite-like crystals were detected only on CPIII, confirmed by phosphorus EDS peaks only for CPIII. Cells attached and proliferated similarly well on all the substrates except C\textendash\textendash. These results prove the feasibility of obtaining biocompatible and bioactive coatings on Portland cement for bone tissue engineering applications.

Keywords

Portland cement; Carbonated apatite; Bioactivity; Bone tissue engineering; Calcium phosphates

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