Iron inhibits hydroxyapatite crystal growth in vitro

Hemochromatosis is a known cause of osteoporosis in which the pathophysiology of bone loss is largely unknown and the role of iron remains questionable. We have investigated the effects of iron on the growth of hydroxyapatite crystals in vitro on carboxymethylated poly(2-hydroxyethyl methacrylate) pellets. This noncellular and enzyme-independent model mimics the calcification of woven bone (composed of calcospherites made of hydroxyapatite crystals). Polymer pellets were incubated with body fluid containing iron at increasing concentrations (20, 40, 60 μmol/L). Hydroxyapatite growth was studied by chemical analysis, scanning electron microscopy, and Raman microscopy. When incubated in body fluid containing iron, significant differences were observed with control pellets. Iron was detected at a concentration of 5.41- to 7.16-fold that of controls. In pellets incubated with iron, there was a ∼3- to 4-fold decrease of Ca and P and a ∼1.3- to 1.4-fold increase in the Ca/P ratio. There was no significant difference among the iron groups of pellets, but a trend to a decrease of Ca with the increase of iron concentration was noted. Calcospherite diameters were significantly lower on pellets incubated with iron. Raman microspectroscopy showed a decrease in crystallinity (measured by the full width of the half height of the 960 Δcm⁻¹ band) with a significant increase in carbonate substitution (measured by the intensity ratio of 1071 to 960 Δcm⁻¹ band). Energy dispersive x-ray analysis identified iron in the calcospherites. In vitro, iron is capable to inhibit bone crystal growth with significant changes in crystallinity and carbonate substitution.
Liens

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