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# The Release Kinetics, Antimicrobial Activity and Cytocompatibility of Differently Prepared Collagen/Hydroxyapatite/Vancomycin Layers: Microstructure vs. Nanostructure

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**Abstract**

The aim of this study was to develop an osteo-inductive resorbable layer allowing the controlled elution of antibiotics to be used as a bone/implant bioactive interface particularly in the case of prosthetic joint infections, or as a preventative procedure with respect to primary joint replacement at a potentially infected site. An evaluation was performed of the vancomycin release kinetics, antimicrobial efficiency and cytocompatibility of collagen/hydroxyapatite layers containing vancomycin prepared employing different hydroxyapatite concentrations. Collagen layers with various levels of porosity and structure were prepared using three different methods: by means of the lyophilisation and electrospinning of dispersions with 0, 5 and 15wt% of hydroxyapatite and 10wt% of vancomycin, and by means of the electrospinning of dispersions with 0, 5 and 15wt% of hydroxyapatite followed by impregnation with 10wt% of vancomycin.

The maximum concentration of the released active form of vancomycin characterized by means of HPLC was achieved via the vancomycin impregnation of the electrospun layers, whereas the lowest concentration was determined for those layers electrospun directly from a collagen solution containing vancomycin. Agar diffusion testing revealed that the electrospun impregnated layers exhibited the highest level of activity. It was determined that modification using hydroxyapatite exerts no strong effect on vancomycin evolution. All the tested samples exhibited sufficient cytocompatibility with no indication of cytotoxic effects using human osteoblastic cells in direct contact with the layers or in 24-hour infusions thereof. The results herein suggest that nano-structured collagen-hydroxyapatite layers impregnated with vancomycin following cross-linking provide suitable candidates for use as local drug delivery carriers.