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New Advances in Fibroblast Growth Factor-Based Coatings for Hip Replacement Implants †

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Abstract: It is already well known that the tissue–implant interface is one of the most critical factors for the success of implant integration. The use of bioactive and biomimetic surfaces is of great interest in biomedical applications, especially in tissue engineering. Therefore, in our study, we aimed to obtain successful coatings based on hydroxyapatite, antibiotics and growth factors in order to increase the biocompatibility of commercial implant materials by promoting cell attachment and growth without toxic effects, as well as the inhibition of microbial biofilm formation. In this way, homogenous mixtures of hydroxyapatite, kanamycin and fibroblast growth factor (HAP/KAN, HAP/FGF and HAP/KAN/FGF) were coated on titanium-based metal plates for hip replacement implants. The coatings were able to impair the initial adherence of bacterial cells and to reduce biofilm formation throughout the release of antibiotics. The cytocompatibility of these samples was investigated on normal murine osteoblasts (MC3T3-E1 cell line) with fibroblast-like morphologies by evaluating their influence on cellular viability and their potential to generate an inflammatory response. In addition, adhesion and proliferation, as well as actin cytoskeleton organization, were observed after 24 h of cell culture on these coatings. The results confirmed the biocompatibility of all coatings, with the cell number counted for the HAP/KAN/FGF sample being equal to the control. Since it is well known that NO is a marker of inflammation with an essential role in regulating apoptotic cell death and cell viability, our study showed that cell growth on these surfaces did not induce nitric oxide (NO) release, with the NO level being maintained close to control values for all tested samples. Moreover, an excellent cell adherence and spreading on these coatings deposited on hip implants was evidenced by fluorescence microscopy, supporting their usage as substrates in tissue engineering applications.

Keywords: biocoatings; fibroblast growth factor; hydroxyapatite; kanamycin; hip implants

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