HUMAN OSTEOBLAST-LIKE MG-63 CELLS ON SURFACE-MODIFIED METALLIC AND POLYMERIC MATERIALS DEVELOPED FOR ARTIFICIAL JOINT REPLACEMENTS

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Abstract

The interaction of cells with materials designed for body implantation depends on physicochemical surface properties of these materials. In this study, we investigated the behavior of human osteoblast-like MG-63 cells in cultures on Ti-6Al-4V alloy, stainless steel AISI 316 LWM, polyetheretherketon (PEEK) and ultra-high molecular weight polyethylene (UHMWPE) modified by shot blasting, polishing, coating with amorphous hydrogenated carbon (a-C:H) and combinations of these treatments.

On days 1 after seeding, the highest cell number and spreading were obtained on shot-blasted and a-C:H-coated Ti-6Al-4V. These cells also contained the highest concentration of beta1-integrin adhesion receptors.

On day 3, the highest cell numbers were obtained on polished and a-C:H-coated Ti-6Al-4V. A relatively high cell number was also obtained on polished stainless steel. The cells on both types of samples contained the highest concentrations of alphav-integrins, vinculin and osteocalcin.

On day 8, the highest cell numbers were obtained on shot-blasted and a-C:H-coated Ti-6Al-4V and on non-modified PEEK. The cells on non-modified PEEK contained a relatively high concentration of talin, and on polished PEEK, the highest concentration of osteopontin. The lowest cell number was obtained on polished and relatively highly hydrophobic UHMWPE.

Therefore, the shot-blasted and a-C:H-coated Ti-6Al-4V, polished stainless steel and PEEK seem to be the most appropriate materials for constructing bone-anchoring parts of joint prostheses, while polished UHMWPE can be used for creation of articular surfaces, where the colonization with cells is not desirable.

Keywords: Bone implants, surface modification, physicochemical surface properties, bone tissue engineering, stem cells, osteoblasts, cell adhesion molecules, osteogenic differentiation

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