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Live Cell Imaging of Bone Marrow Stromal Cells on Nano-pitted and Polished Titanium Surfaces: A Micro-Incubator in vitro Approach

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Live Cell Imaging of Bone Marrow Stromal Cells on Nano-pitted and Polished Titanium Surfaces: A Micro-Incubator in vitro Approach

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Abstract

Current orthopedic implants are not conducive for optimal integration of the biomaterial with newly-formed tissue (osseointegration) inside a patient's body. In this study, medical-grade Ti-6Al-4V was used as a substrate due to its biocompatibility and ability to facilitate cellular adhesion and proliferation. Live cell imaging was conducted on bone marrow stromal cells, genetically modified to express the green fluorescent protein (GFP), from the 24-96 hours growth period, with the first 24 hours of growth being held inside a lab-scale incubator. Periodic images were recorded on nano-pitted anodized and polished Ti-6Al-4V substrates to study how substrate-stiffness influences adhesion and proliferation. Collected images were analyzed for mitosis, adhesion, and filopodia-stretchability using ImageJ, an image processing program. Images were enhanced in order to perform cell counts at 24, 48, 72, and 96 hours of growth. Continuous recordings were produced to account for the number of mitosis occurrences and cellular migration on each of the substrates. Based on the conducted experiments, it appears that polished Ti-6Al-4V has a higher cell adherence than "nano-pitted" anodized surface and an improved rate of proliferation which may be because the cells once adhered on the nano-pitted surface have less ability to detach in-order to undergo mitosis.