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IN VITRO AND IN VIVO BIOCOMPATIBILITY OF DIAMOND-LIKE CARBON FILMS INCORPORATING TITANIUM DIOXIDE NANOPARTICLES FOR BIOMEDICAL IMPLANT

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Diamond-like carbon (DLC) films possess desirable characteristics in materials for biomedical use such as: biocompatibility due to its composition of carbon and hydrogen only, which are biologically compatible with human cells for numerous applications biomedical. The films were grown on 316 stainless steel substrates using plasma enhanced chemical vapor deposition from a dispersion of titanium dioxide (TiO2) nanopowder in hexane. In this study, the in vitro and in vivo cytotoxicity and biocompatibility of DLC coatings containing TiO2 nanoparticles was investigated. The scratching test showed good adhesion to the substrate. Even after the first crack, the film continues adhered and working as a protective and friction reducer. The in vitro results showed that as the concentration of TiO2 nanoparticles in DLC films increased, the mitochondrial activity also increased and LDH activity decreased. The fluorescence microscopy revealed that the number of cells increased, and the integrity of the cells was kept on DLC and TiO2-DLC films. The results showed osteoblasts adhesion increased in the presence of TiO2 nanoparticles in DLC structure. The in vivo results demonstrated that the interaction between macrophages and the films did not induce cellular inflammatory reactions. There was a significant increase in nitric oxide production in steel, that was confirmed through the cytometry, whereas DLC and TiO2-DLC groups demonstrated biocompatibility. The inducible nitric oxide synthase (iNOS) is not highlighted, then the macrophages were not activated, therefore, there was no evidence of inflammation. From the in vitro and in vivo results, the DLC and TiO2-DLC films were considered biocompatible, allowing their use as protective coatings with low friction coefficient. These experiments show the potential use of DLC and TiO2-DLC films in biomedical applications.