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Modification of Titanium Surfaces with Micro/Nanospheres for Local Antibiotic Release

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Abstract : Titanium and titanium-based materials are commonly used to replace or regenerate the injured or lost tissues because of accidents or illnesses. Hospital infections and strong bond formation at the implant-tissue interface are directly affecting the success of the implantation as weak bonding with the native tissue and hospital infections lead to revision surgery. The purpose of the presented study is to modify the surface of the titanium substrates with nano/microspheres for local drug delivery and to prevent hospital infections. Firstly, titanium surfaces were silanized with APTES (3-Triethoxysilylpropylamine) following the negatively charged oxide layer formation. Then characterization studies using Scanning Electron Microscopy (SEM) and Fourier transform infrared spectroscopy (FTIR) were done on the modified surfaces. Secondly, microspheres/nanospheres were prepared with chitosan that is a natural polymer and having valuable properties such as non-toxicity, high biocompatibility, low allergen city and biodegradability for biomedical applications. Antibiotic (ciprofloxacin) loaded micro/nanospheres have been fabricated using emulsion cross-linking method and have been immobilized onto the titanium surfaces with different immobilization techniques such as covalent bond and entrapment. Optimization studies on size and drug loading capacities of micro/nanospheres were conducted before the immobilization process. Light microscopy and SEM were used to visualize and measure the size of the produced micro/nanospheres. Loaded and released drug amounts were determined by using UV- spectrophotometer at 278 nm. Finally, SEM analysis and drug release studies on the micro/nanospheres coated Ti surfaces were done. As a conclusion, it was shown that micro/nanospheres were immobilized onto the surfaces successfully and drug release from these surfaces was in a controlled manner. Moreover, the density of the micro/nanospheres after the drug release studies was higher on the surfaces where the entrapment technique was used for immobilization. Acknowledgement: This work is financially supported by The Scientific and Technological Research Council Of Turkey (Project # 217M220)

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