Title: "Nanomechanical properties on surfaces with using AFM & Nanoindenter"
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Αγγλική περίληψη

This master thesis studies the nanomechanical properties of biodegradable polymeric thin films nanofibrous scaffolds of polycaprolactone (PCL) with two methods (AFM - Nanoindenter). These samples were prepared by the Electrospray Deposition method to enhance the mechanical behavior of natural polymeric scaffolds for cartilage regeneration. The aim was to establish the limitations of the study by two ways of nanomechanical properties. The instruments used to study the nanomechanical properties (modulus, hardness) are: a) Atomic Force Microscopy - AFM Multimode of Digital Instruments, Veeco, b) Triboscope Nanomechanical Test System, Hysitron Inc. Using the AFM for taking the force - distance curves. The treatment was performed in external software (Nanoscope Analysis) given by the company. The software is using two models of analysis depending on the tip. These models are the Hertz model (spherical tip) and the Sneddon model (conical or pyramidal). The tips used were made of silicon nitride (pyramidal), and a Colloidal Probe with a silicon dioxide sphere of 6,62μm diameter at its end (use in study on cells). Using Nanoindenter obtained force - depth of penetration curves with Berkovich tip. The loads used were from 50μN to 500μN. The treatment was made directly by the instrument software using the Oliver - Pharr model. The samples studied, the concerning material is moderately hard, soft to very soft. Finally, cell adhesion (MG 63 human osteosarcoma cells) was studied. More specifically we tested a) UHMWPE, b) 30% w/v PCL with solvent 90% acetic acid, c) 30% w/v PCL + 5% w/v chi with solvent 90% v/v acetic acid and d)30% w/v PCL + 5% w/v chi with solvent 90% v/v acetic acid (untreated). Then the sample 30% w/v PCL + 5% w/v chi with solvent 90% v/v acetic acid was performed, in order to adhere the cells on a surface of gelatin coating. At each stage of the latter procedure were studied nanomechanical properties. As a general observation, using Nanoindenter works best for hard materials and soft to moderate. Unlike using the AFM, it was observed that it works well on soft samples. The AFM method is effective for the study of mechanical properties of the cell during cell adhesion. The unique advantage of the method AFM is the opportunity to perform the measurement of mechanical properties of cells and visualizing important cellular structures. Finally, depending on the material we experience whenever we could develop models which will be approached in a more correct way interaction tip - surface instead of relying on the results of the finished models included in the instrument software.