HYDROXIAPIATITE-PHOSPHOLIPIDS COATINGS INFLUENCE THE BEHAVIOR OF OSTEOBLASTS PRIMARY CULTURES IN TITANIUM IMPLANTS

A. N. de Faria¹, D. C. Zancanela², M. A. Cruz², G. Ruiz², A. P. Ramos², P. Ciancaglini²

¹Departamento de Bioquímica, Faculdade de Medicina de Ribeirão Preto, Universidade de São Paulo, Brasil; ²Departamento de Química, Faculdade de Filosofia, Ciências e Letras de Ribeirão Preto, Universidade de São Paulo, Brasil.

Hydroxyapatite (HAp) coatings are used to increase the osteointegration in titanium (Ti) implants, due to their ability to promote biomineralization in order to correct skeletal and craniofacial defects. We developed a new coating approach based on Langmuir-Blodgett (LB) films of dihexadecyl phosphate (DHP) and octadecylphosphonic acid (OPA) deposited on Ti discs and subsequent growth of HAp crystals.

The objective was to evaluate the influence of the coatings on osteoblasts primary cultures.

We analyzed the osteoblast viability, alkaline phosphatase (ALP) activity and mineralized matrix formation by colorimetric methods, and scanning electron microscopy and confocal micrographies.

The results revealed that the DHP/HAp coating increased osteoblast viability up to 150% compared to the control at all tested days (7, 14, and 21). The OPA/HAp coating promoted the highest viability at the 14th day (190%). The ALP activity was enhanced only by the DHP/HAp coating at the 14th day compared to control (235.1%), and clean Ti (230.9%). To explore the morphology of the cells, the scanning electron microscopy and confocal micrographies were acquired, and revealed morphological differences between osteoblasts grown on both coated Ti compared to clean Ti. Both coatings increased the number and size of osteoblasts, while the DHP/HAp coating enhanced the production of biomineralized nodules. The Alizarin Red assay showed that OPA/HAp coating have 1.88 times higher calcium (Ca²⁺) concentration than DHP/HAp. The same test confirmed the increase of mineralization only by DHP/Ca coating compared to clean Ti (217.1%). Once the literature reports that Ca²⁺ can stimulate or inhibit the ALP activity and consequently, the biomineralization process, the differences on the behavior of these two coatings could be related to the Ca²⁺ surface concentration differences.

The good performance of the DHP/HAp coating can be explained regarding the characteristics of the chemical composition, added to the LB deposition technique.

Acknowledgements: CAPES, CNPq, FAPESP.

Key Words: Biomineralization; Langmuir-Blodged films; Phospholipids.