In vitro studies of osteoblast activity on biphasic calcium phosphate ceramic surfaces

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INTRODUCTION: Hydroxyapatite (HAp) and β-tricalcium phosphate (β-TCP) ceramics are widely used as bone replacement materials due to their bioactivity and osteoconductive properties. The use of biphasic calcium phosphate (BCP) bioactive ceramics is based on an optimum balance between more stable phase – HAp and more soluble phase – β-TCP. β-TCP supplies surrounding bone and soft tissues with calcium and phosphate ions, HAp enhances biocompatibility and improves mechanical strength.[1,2] Hence it is important to find an optimal ratio between HAp and β-TCP, to ensure the material replacement with the bone tissue during the implant resorbtion. Sintering temperature directly affects the surface area and microporosity of the material. Increasing the sintering temperature decreases both the surface area and microporosity.

METHODS: Biphasic calcium phosphate (HAp/β-TCP) synthesis was carried out by wet precipitation method. The dried precipitate was milled to obtain fine powder. Before sintering, powder was uniaxially pressed into pallets. BCP was sintered at 1000 ^{o}C and 1150 ^{o}C temperature. Obtained samples have HAp/β-TCP ratio 70/30. Porosity, shrinkage, phase composition, surface area and surface morphology of the samples after sintering were evaluated. To determine the adhesion, proliferation and biocompatibility MG63 osteoblast cell line was used. Stability of samples in cell culture medium was determined.

RESULTS: The surface area of samples sintered at 1000 ^{o}C was 8 m^2/g, while surface area of samples sintered at 1150 ^{o}C was ten times lower (0.8 m^2/g). BCP ceramic sintered at 1000°C has a high rate of particle release compared to material sintered at 1150°C. The effect of HAp/β-TCP sintering temperature on osteoblast behaviour was evaluated. Cells are able to adhere and proliferate on both kinds of material, but there are differences in shape and size of cells. Cells seeded on BCP ceramic sintered at 1150°C are more flat and outspread both after 30 min and 24 h than those on material sintered at 1000°C (Fig.1.).

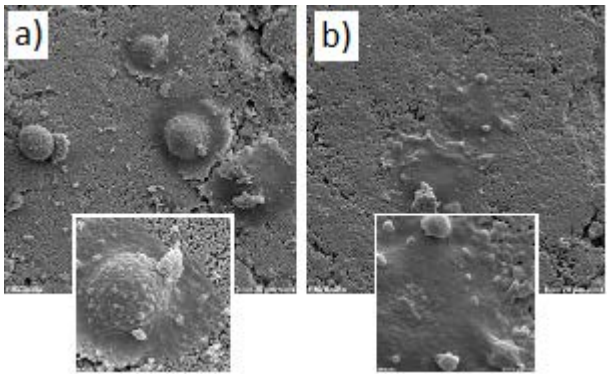

Fig. 1: a)osteoblastic cells MG63 30 min after seeding on BCP sintered at 1000°C; b)osteoblastic cells MG63 30 min after seeding on BCP sintered at 1150°C.

DISCUSSION & CONCLUSIONS: Both kinds of biomaterial are appropriate for cell culture applications. However, the material sintered at 1000°C shows a higher rate of particle release which has a negative effect on cell growth.

REFERENCES: [1] F. Monchau, A. Lefevre, et al (2002) *Biomol. Eng.* **19**:143-152. [2] X. Wang, H. Fan, et al (2006) *Mater. Lett.***60**:455-458.

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