Nurse´s A-phase material enhance adhesion, growth and differentiation of human bone marrow-derived stromal mesenchymal stem cells

Rabadan-Ros Ruben[1], Aznar-Cervantes Salvador[2], Mazón Patricia[3], Ros-Tarraga Patricia[1], De Aza Piedad N.[4], Meseguer-Olmo Luis[1]

[1] Regeneration and tissue repair Group at UCAM – Universidad Católica San Antonio de Murcia, Guadalupe (30120), Murcia, Spain

[2] Instituto Murciano de Investigación y Desarrollo Agrario y Alimentario (IMIDA), Department of Biotechnology, La Alberca (30150), Murcia. Spain

[3] Department of Materials, Optic y Electronic Technology, Miguel Hernández University, Elche (03202) Alicante, Spain

[4] Institute of Bioengineering, Miguel Hernández University, Elche (03202), Alicante, Spain

Abstract

Silicon (Si) is a trace element that enhances bone formation and maturation in the body; thus apatite ceramics containing Si are expected to increase the speed of bony regeneration.

The mesenchymal stem cells from human bone marrow (*ah*MSCs) are a great promise for cell-based therapies by their ability to differentiate into osteoblast in certain microenvironments. The purpose of this study was to evaluate the effect of a well-characterized Nurse´s A-phase ($7CaO{\cdot}P_2O_5{\cdot}2SiO_2$) ceramic compared to a control (tissue culture polystyrene-TCPS) on osteogenic differentiation of *ah*MSCs in vitro. Alizarin Red-S (AR-s) staining, alkaline phosphatase (ALP) activity, and collagen I (COLI) were evaluated. Also, field emission scanning electron microscopy (FESEM) images were acquired in order to visualise the morphology of the cells.

The entire surface was colonized after 28 days of culture in growth medium (GM). Osteoblastic differentiation markers were significantly enhanced in cells growing on Nurse´s A phase ceramic and cultured with osteogenic medium (OM), and cells acquired polygonal shape typical from osteoblasts, probably due to the role of silica to stimulate the differentiation of *ah*MSCs. Moreover, calcium nodules were formed under the influence of ceramic material.

Therefore, it is predicted that Nurse´s A-phase ceramic would present high biocompatibility and good osteoconductivity, being a good candidate to be used as a biomaterial for bone tissue engineering.

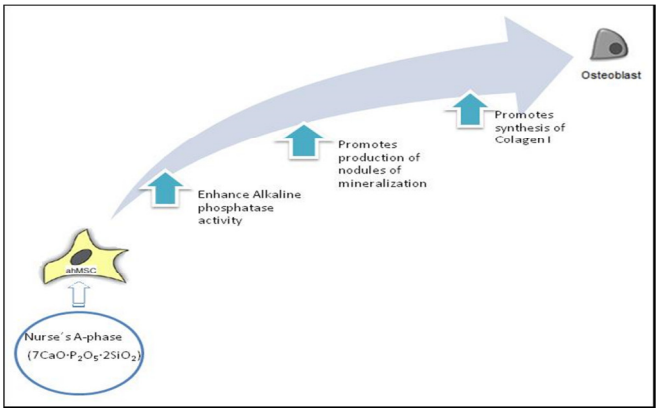

Figure 1. Osteoblastic differentiation markers were significantly enhanced in cells growing with Nurse´s A phase ceramic

Recent Publications

1. Ros-Tárraga, P., Rabadan-Ros, R., Murciano, A., Meseguer-Olmo, L., & De Aza, P. N. Assessment of Effects of Si-Ca-P Biphasic Ceramic on the Osteogenic Differentiation of a Population of Multipotent Adult Human Stem Cells. Materials 2016, 9(12), 969.

2. Ros-Tárraga, P.; Mazón, P.; Rodríguez, M.A.; Meseguer-Olmo, L.; De Aza, P.N. Novel resorbable and osteoconductive calcium silicophosphate scaffold induced bone formation. Materials 2016, 9, 78

3. Lugo, G.J.; Mazón, P.; Piedad, N. Material processing of a new calcium silicophosphate ceramic. Ceramics International 2016, 42, 673-680.

4. Rabadan-Ros, R.; Velásquez, P.A.; Meseguer-Olmo, L.; De Aza, P.N. Morphological and structural study of a novel porous nurse's a ceramic with osteoconductive properties for tissue engineering. Materials 2016, 9, 474.

5. Rabadan-Ros, R.; Mazón, P.; Serena, S.; Sainz Ma. A.; Meseguer-Olmo L.; De Aza, P. N. In vitro behaviour of Nurse´s Ass-phase: a new calcium silicophosphate ceramic. Journal of the European Ceramic Society DOI: 10.1016/j.jeurceramsoc.2017.03.014

6. Rabadan-Ros, R.; Aznar-Cervantes, S., Mazón, P.; Ros-Tarraga, P.; De Aza, P. N.; Meseguer-Olmo L.; Nurse´s A-phase material enhance adhesion, growth and differentiation of human bone marrow-derived stromal mesenchymal stem cells. Materials, 2017, in press.

Biography

My name is Rubén Rabadán Ros, I am biologist by the University of Murcia (UMU) and I have a MSc degree in Molecular Biology and Biotechnology by the same university. Currently, I am a PhD student in Biomedical Sciences at *Universidad Católica San Antonio, Murcia* (UCAM), developing scaffolds based on the C2S-TCP *phase diagram* and their in *vitro* and in vivo study.

Email:
rubenrabadanros@gmail.com

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