Poster

Evaluation of biocompatibility and biodegradability of a new vitreous silica-based material

Alicia Ortega Rodríguez, Leonor Santos-Ruíz, José Becerra Ratia

Universidad de Málaga, Departamento de Biología Celular, Genética y Fisiología, Facultad de Ciencias, Campus de Teatinos, 29071 Málaga.

BIONAND-Universidad de Málaga, c/Severo Ochoa 35, Campanillas, 29590 Málaga.

Keywords: Biomaterial; biocompatible; biodegradability.

ABSTRACT

Motivation: Biomaterials have an importal role in tissue regeneration so that they must perform some features. Biomaterials have to be biocompatible with the body, that is, accept it without causing reactions of rejection or toxicity, as inflammatory responses or blood clotting; and also help the cells around him to continue performing their vital processes. Furthermore, it has to be bioresorbable, it mean, it must have the capacity to degrade partially or totally in a suitable period of time so that the organism can to metabolize it and replace it with new tissue.

This work's main objetive is to evaluate a new silica-based vitreous material (BCG) in vivo by testing in an animal model. For this, the biocompatibility and biodegradability of the material will be studied.

Methods: The material was implanted subcutaneously in adult rats of the Wistar strain. A magnetic resonance imaging (MRI) device was used for the weekly monitoring of the implants in a non-invasive way. After 28 days, the animals were sacrificed, and it was studied by image acquisition by computerized axial tomography (CAT). The implants were isolated for further histological processing.

The images of MRI and CAT were subjected to image analysis to determine the volume of the implants in each sample time, and from this point, their degradation rate in vivo. The implants extracted from the animals were included in resin and histological sections were obtained. Different stains were performed such as hematoxylin-eosin to observe the general state of the tissue, picrosirio to observe the deposition of collagen in the implants, Goldner's trichrome to differentiate several tissues, and histochemistry of lectins to observe blood vessels.

Results and conclusions: The material does not produce fibrous cyst around the implanted tissue, and also does not show signs of chronic inflammatory response. The tissue of the animal has been able to colonize the material, producing blood irrigation and without causing acute alterations in the area of the implant. These results indicate that it is a biocompatible material that could be used for tissue regeneration. In addition, if it is a bioresorbable material, it will show a decrease in its volume, due to the degradation in the successive weeks of implementation.

REFERENCES

Campana, V., Milano, Giuseppe, Pagano, E., Barba, M., Cicione, C., Salonna, G., ... & Logroscino, G. (2014). Bone substitutes in orthopaedic surgery: from basic science to clinical practice. Journal of Materials Science: Materials in Medicine, 25(10), 2445-2461.

Lin, K., Xia, L., Li, H., Jiang, X., Pan, H., Xu, Y., ... & Chang, J. (2013). Enhanced osteoporotic bone regeneration by strontium-substituted calcium silicate bioactive ceramics. Biomaterials, 34(38), 10028-10042.

Mieszawska, A. J., Fourligas, N., Georgakoudi, I., Ouhib, N. M., Belton, D. J., Perry, C. C., & Kaplan, D. L. (2010). Osteoinductive silk–silica composite biomaterials for bone regeneration. Biomaterials, 31(34), 8902-8910.

O'Neill, E., Awale, G., Daneshmandi, L., Umerah, O., & Lo, K. W. H. (2018). The roles of ions on bone regeneration. Drug Discovery Today.

Wang, W., & Yeung, K. W. (2017). Bone grafts and biomaterials substitutes for bone defect repair: A review. Bioactive Materials.