Chitosan scaffold and mesenchymal stem cells: a tissue engineering purpose

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Cartilage tissue has a poor capacity for self-repair, especially in the case of severe cartilage damage due to trauma or age-related degeneration[1, 2]. Cell-based tissue engineering using scaffolds has provided an option for the repair of cartilage tissue [3].

The present work demonstrates that the three-dimensional (3D) chitosan scaffold increases the efficiency of the adhesion and differentiation process of Mesenchymal Stem Cells (MSCs) after the addition of a chondrogenic medium containing TGF-β. These culture conditions promoted MSC chondrogenesis as it was evaluated during the first 9 weeks of 2D or 3D culture in a scaffold of chitosan + gelatin reticulated with glutaraldehyde or chitosan + gelatin + genipin.

The results demonstrated that both scaffolds caused a reduction in Alkaline Phosphatases production and an increase in the collagen concentration indicating phenotypic changes in the cells.

MSC undifferentiated showed stem cells specific surface markers (CD90 – 87%; CD73 – 94% and CD54 – 95%) and these cells do not present hematopoietic specific surface markers (CD45 – 5%).

Corroborating these results, the collagen type II production by the MSCs cultured in chondrogenic medium, indicating the beginning of differentiation. These scaffolds were available about reabsorption process *in vivo*. Both scaffols were reabsorbed, however the genipin scaffold were more quickly than gluraldehyde.

Considering the results obtained using a chitosan matrix to promote MSC differentiation, it becomes clear that this 3D organic structure is a promising candidate for biomaterial implants designed to promote MSC colonization for applications in regenerative medicine.

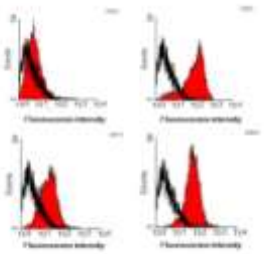

Fig 1 – Expression of specific and non-especific mesenchymal stem cells surface markers.

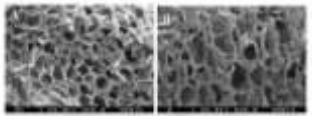

Fig 2 – Porosity of scaffolds (right - glutaraldehyde and left – genipin).

Fig 3 – PCR analyze. (A) Colagen II and (B) actin

[1] Buckwalter JA. Articular cartilage: injuries and potential for healing. J Orthop Sports Phys Ther 1998; 28: 192–202.
[2] Redman SN, Oldfield SF, Archer CW. Current strategies for articular cartilage repair. Eur Cells Mater 2005; 9: 23–32.
[3] Richardson SM, Curran JM, Chen R, Vaughan-Thomas A, Hunt JA, Freemont AJ, Hoyland JA. The differentiation of bone marrow mesenchymal stem cells into chondrocyte-like cells on poly-L-lactic acid (PLLA) scaffolds. Biomaterials 2006; 27: 4069-78.