Osteogenic Differentiation of Adipose Stem Cells by Endothelial Cells Co-culture within Liquified Capsules

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Inspired by the native co-existence of multiple cell types and from the concept of deconstructing the "stem cell niche", we propose a co-culture strategy within liquified capsules. The present team has already proven the application of liquified capsules as bioencapsulation systems 1. Here, we intend to use the optimized system towards osteogenic differentiation. Capsules containing adipose stem cells alone (MONO-capsules) or in co-culture with endothelial cells (CO capsules) were maintained in endothelial medium with or without osteogenic differentiation factors. The suitability of the capsules for living stem and endothelial cells encapsulation was demonstrated by MTS and DNA assays. The osteogenic differentiation was assessed by quantifying the deposition of calcium and the activity of ALP up to 21 days. CO capsules had an enhanced osteogenic differentiation, even when cultured in the absence of osteogenic factors. An enhanced osteogenic differentiation in the CO capsules was confirmed by the upregulation of osteogenic markers (BMP-2, RUNX2, BSP) while angiogenic markers expression (VEGF, vWF, CD31) revealed the presence of endothelial cells. Osteopontin and CD31 could be detected, which respectively confirmed the osteogenic differentiation and the maintenance of endothelial cells phenotype. The proposed capsules can also act as a growth factor release system, as showed by VEGF and BMP-2 release profiles. These findings demonstrate that the co-encapsulation of stem and endothelial cells within liquified injectable capsules provides a promising strategy for bone tissue engineering.

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