Roberto Loi, Madridge J Cancer Stud Res. 2018
http://dx.doi.org/10.18689/2640-5180.a3.007

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International Conference on
Stem Cells and Cell Biology
December 6-7, 2018 Valencia, Spain

Molecular Characterization of the Osteogenic Differentiation Process in Mouse Bone Marrow-Derived Mesenchymal Stem Cells (MSCs) and Induced Pluripotent Stem Cells (iPSCs)

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Mesenchymal stem cells (MSC) and induced pluripotent stem cells (iPSC) are promising cell sources for regenerative medicine approaches. In the present study, we characterized and compared the osteogenic differentiation process of mouse bone marrow-derived MSCs and iPSCs, *in vitro*.

Both cell types were subjected to osteogenic differentiation following medium supplementation with 100nM dexamethasone, 50 µg/ml ascorbic acid and 10 mM β-glycerol phosphate.Osteodifferentiation was assessed at 1 week and 4 weeks of induction for both cell types.During osteogenic induction, progressive loss of markers of pluripotency was observed in iPS cells by RT-PCR, coupled to initial upregulation of the mesodermal genes MSX2, NCAM, HOXA2. In parallel, loss of specific markers was observed in MSC. The phenotype of differentiated cells was assessed by evaluation of the expression levels of osteogenic differentiation markers by RT-PCR, including Runx2, Osteopontin, Osteocalcin, Collagen type I, Osterix, Alkaline phosphatase. Furthermore, matrix mineralization was evaluated by Alizarin S staining. Both in MSCs and in iPSCs the expression of genes related to osteogenic differentiation was significantly higher at 4 weeks compared to 1 week of inducing culture. Upregulation of the transcription factor SATB2 was detected by RT-PCR in both cell types during osteogenic differentiation, indicating the involvement of the SATB2/RUNX2 axis. A comparison of the expression levels of markers of osteogenesis between MSCs and iPSCs, revealed no significant differences overall ($p>0,05$ for each marker), being the expression of osteogenic markers slightly higher in MSCs compared to iPSCs at 1 week, with an opposite trend at 4 weeks. Overall, the results indicate that these two cell types have a comparable potential towards osteogenic differentiation.

Thus, this study shows that both bone marrow-derived MSCs and iPSCs represent two equally valid alternative cell sources for regenerative medicine and tissue engineering approaches for bone defects correction.

Biography:

Roberto Loi, Ph. D., is Assistant Professor at the University of Cagliari, Italy. His research activity has been focused on stem cells since 2003. At that time he joined the laboratory of Prof. Daniel J. Weiss at the University of Vermont, USA, and started to study the differentiation potential of mesenchymal stem cells towards airway epithelial lineages as a potential therapeutic approach for cystic fibrosis. His research interests include the generation of iPS cells and their differentiation into various cell lineages, and the development of acellular lung scaffolds for regenerative medicine.