MSCS FUNCTIONALIZED WITH OSTEOPHILIC POLYMER ENHANCE COMPACT BONE REGENERATION IN OSTEOPOROTIC RAT MODEL IN VIVO

Y.Safarova (Yantsen)[1,2], F.Olzhayev[1], D.Idrissova[1], B.Umbayev, H.Murata[3], R.Koepsel[3], A.Russell[3], Sh.Askarova[1]

[1]National Laboratory Astana, Nazarbayev University (Astana, Kazakhstan)
[2]School of Engineering, Nazarbayev University Astana, Kazakhstan)
[3] Institute for Complex Engineered Systems, Carnegie Mellon University (Pittsburgh,PA, USA)
shaskarova@nu.edu.kz

Abstract: Undeniable increase in osteoporotic fractures is associated mainly with the global population aging. Age-related alterations shift bone metabolism to induced osteoclastic activity and reduction of osteoblasts that consequently result in progressive bone loss. In this case transplantation of osteoblast precursor cells, mesenchymal stem cells, may be an option. Bone targeted MSCs delivery can potentially increase the efficiency of cell therapy. To ensure the targeting potential osteophilic polymer was synthesized using atom transfer radical polymerization (ATRP). The polymer binds the cells and navigates the cell to the hydroxyapatite on the surface of the compact bone. Surrounding environment promotes MSCs differentiation along the osteogenic lineage. Therapeutic effect was observed in ulna fracture in osteoporotic rat models induced by OVX via measuring bone density and histological assessment. Polymer functionalized MSCs were administrated locally at the site of the fracture at concentration 1e6 cells/ml every week during 1 month. Micro-CT morphometry analysis revealed significantly improved bone mass indicators. Histological assessment showed formation of the young bone tissue from immature cells at fracture zone.

Keywords: osteoporosis, bone metabolism, mesenchymal stem cells, ATRP synthesis, cell therapy, targeted cell delivery