

Effect of biophysical stimulation for osteogenic differentiation

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Human mesenchymal stem cells (hBM-MSCs) have a capacity of osteogenic differentiation. Biophysical stimulation exposure increase osteogenic differentiation of hBM-MSCs. Nanomagnetic particles (MPs) also promote differentiation potential of stem cells. In this study we investigated the effects of biophysical stimulation (electromagnetic fields) and nanomagnetic particle increase osteogenic differentiation of hBM-MSCs. We treated 50ug/ml of Fe₃O₄ MPs on the hBM-MSCs or exposed them to a frequency of 45Hz and intensity of 1mT EMF for 2 times 8 hours per day. MP-incorporation, EMF exposure and MP-incorporated with exposed EMF do not induce cytotoxicity. The osteogenesis markers were strongly expressed in the MP-incorporated, exposed EMF and MP-incorporated with exposed EMF group compared to control group by immunohistochemical staining, qRT-PCR and western blot. FACS analysis was performed for hBM-MSC markers. The MP-incorporated with exposed EMF increase ALP activity in hBM-MSCs. These results suggest that MP treatment or EMF exposure of hBM-MSCs can increase osteogenic differentiation and MP incorporate with EMF exposure is more efficient in osteogenic differentiation.