Abstract

The main function of mesenchymal stem cells in the body is to facilitate the restoration and regeneration of damaged tissues. They are known for the ability to differentiate into tissue originating from the mesoderm, which among others includes connective tissues. Due to this feature are MSCs being intensively examined. Different directions of differentiation can be induced by treatment of specific polypeptides, so called growth factors. In the field of tissue engineering are growth factors used to induce and accelerate the healing processes. They may be incorporated into the nanofiber carrier which is inserted into the site of injury. Cells in this area would thus be stimulated by surrounding 3D microenvironment. At the same time the scaffold provides a supply of growth factors which are able to affect metabolism, motility and differentiation of present cells. In order to induce osteogenic differentiation of human MSCs the following bioactive substances were used: TGF-β, bFGF, HGF, IGF-1, VEGF and the BMP-2 and the organic acid taurine. During 21 days lasting experiments, were these molecules added to the medium in various combinations and in the case of taurine also at two different concentrations. Cells were cultured on plastic. The best effect on cellular metabolism of MSCs, evaluated by MTS assay, had growth factors TGF-β and bFGF added to the culture medium either separately or combined. Decrease of metabolic activity was measured when VEGF, HGF and 20 mM taurine were added. Stimulatory effect on alkaline phosphatase activity had growth factors VEGF and IGF-1 alone or in combination, and 20 mM taurine. In cases when they were added into the medium containing TGF-β and/or bFGF, which decreased ALP activity, they also had an inhibitory effect. Mineralization rate of cells was, as ALP activity, negatively affected by supplements of TGF-β and bFGF alone or in combinations. Mineralization was positively influenced by the addition of 20 mM taurine, HGF, IGF-1 and BMP-2 which was being added in the second phase of cell cultivation (day 14 to 21), if not combined with TGF-β. RunX2 expression was induced by TGF-β and bFGF, as well as the expression of type I collagen. These growth factors have a positive effect both separately and in combination. Combining of more than two growth factors with aim to increase cell metabolism and the activity of ALP seemed to be useless. In some cases, an inhibition was induced.