

ABSTRACT

Mesenchymal stem cells (MSCs) represent a type of stem cells, localized in various tissues, where they are involved in the regeneration process. Because of their properties, MSC are tested for cell-based therapy. However, the treatment of injuries is often associated with bacterial infections, which complicate the process of healing. To establish a sterile environment, metallic nanoparticles (NPs) with proven antibacterial properties can be applied, for improving the healing process. Mechanisms of the antibacterial effect of NPs are non-specific and may cause the damage of eukaryotic cells.

The aim of this thesis was to evaluate the effect of three antibacterial metallic NPs (silver, copper oxide and titanium dioxide) on the functional and regenerative properties of MSCs. The effect of NPs on the metabolic activity, differentiatonal potential, expression of genes for immunoregulatory molecules and production of cytokines by MSCs was determined. Additionally, the immunoregulatory properties of MSCs after cultivation with NPs were tested. The results showed that the metabolic activity was reduced in the presence of silver and copper oxide NPs, with the decrease dependent on the type of the tested NPs. The expression of selected immunoregulatory molecules was inhibited and the immunoregulatory properties of MSCs were also reduced after cultivation with silver NPs. In a skin wound model, the effect of silver NPs on the regeneration potential of MSCs was analysed. The combined application of MSCs and silver NPs induced changes in the regeneration potential of MSCs, which were evaluated by the detection of expression of genes for molecules that participate in the wound healing process.

Key words: copper oxide nanoparticles, cytokines, immunoregulation, mesenchymal stem cells, regeneration, silver nanoparticles, titanium dioxide nanoparticles