THE IMPACT OF UNMODIFIED GRAPHENE - BASED SUBSTRATES ON BASIC PROPERTIES OF HUMAN UMBILICAL CORD-DERIVED MESENCHYMAL STEM CELLS *IN VITRO*

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Introduction

Stem cells (SCs) are a unique type of cells with high self-renewal potential and the ability to differentiate into specialized cell types that build human tissues and organs. One of the most promising groups of stem cells are human umbilical cord-derived mesenchymal stem cells (hUC-MSCs). hUC-MSCs are distinguished by high proliferative potential, the ability to differentiate into many cell types such as chondrocytes, osteocytes or adipocytes, and a non-invasive method of obtaining [1]. Therefore, hUC-MSCs are a promising therapeutic tool in regenerative medicine and tissue engineering.

In order to effectively use the potential of hUC-MSC for differentiation and tissue regeneration, new biocompatible scaffolds for cell culture are still being sought for. An interesting material for biomedical applications due to its unique physicochemical properties is graphene and its derivatives [2, 3].

The main goal of this study was to investigate the impact of unmodified graphene-based substrates on the morphology, proliferation and viability of hUC-MSCs.

Materials and Methods

Various types of solvents (water, ethanol) and thickness of the graphene layer were tested in the studies. After 72 hours of cell culture of graphene surface we investigated the effect of pure graphene and graphene with the addition of surfactant (Pluronic PE 6400) on the morphology, proliferative capacity and cell viability of hUC-MSCs. The proliferation rate was evaluated using a cell counter. Cell viability and apoptosis were measured by using FITC Annexin V Apoptosis Detection Kit and analyzed by flow cytometer.

Results and Discussion

Obtained results revealed that the tested unmodified graphene - based substrates reduce the proliferation and viability of hUC-MSCs compared with control conditions (TC-treated plastic). Cell proliferation and viability decreased with increasing thickness of the graphene layer. The most preferred cell scaffold for cell viability was pure graphene prepared in ethanol solvent.

Conclusions

The presented results indicate the need for further research for the biofunctionalization of unmodified graphene-based substrates, which would increase their biocompatibility for stem cells and enable their biomedical application.

Acknowledgments

References

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