POLYURETHANE COMPOSITES AS A POTENTIAL 3D SCAFFOLD FOR MESENCHYMAL STEM CELLS IN CARTILAGE REGENERATION

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Introduction
Osteoarthritis (OA) is characterized as a degeneration of articular cartilage. Cartilage is a highly specialised tissue with a low regenerative potential. Traditional OA treatment methods are not able to stop the disease progression and are mainly focused on pain control. Therefore there is a growing interest in regenerative medicine such as cell therapy, where cells are injected directly into the damage tissues, and tissue engineering, where cell-scaffold combinations are used to repair the tissues [1, 2]. One of the most promising type of stem cells in cartilage regeneration are mesenchymal stem cells (MSCs) that have the ability to differentiate into chondrocytes [2].
In our research we tested the possibility of using modified polyurethane composites as a biocompatible 3D scaffold for Mesenchymal Stem Cells.

Materials and Methods
In the studies were used native and modified polyurethane composites synthesized by the Project partner (AGH). The experimental scheme was planned according to the guidelines of the ISO 10993 Biological evaluation of medical devices.
The effect of PU composites on human umbilical cord MSCs was checked by indirect and direct tests. Indirect tests were to examine the effect of substance released from the polyurethane on the MSCs. For indirect tests were used Cell Counting Kit 8 (Sigma Aldrich), (CyQuant Cell Proliferation Assay Thermo Fisher Scientific) and Cytotoxicity Detection Kit (Sigma Aldrich). Direct tests were performed to check the effect of cell composite interaction on the proliferation of MSCs. For indirect test was used ATPlite Luminescence Assay (Perkin Elmer).
Each test was performed according to the manufacturer's protocol in three independent replicates.

Results and Discussion
Our results obtained in short term indirect tests show that the cell viability and proliferative capacity of mesenchymal stem cells exposed to soluble substances released from the tested polyurethane composites are comparable to the control conditions. There was also no cytotoxic effect observed. This may indicate that the investigated polyurethane composites do not secrete toxic substances for MSCs. In tests of direct contact of MSCs with the tested biomaterials a significant decrease in cell viability was observed, followed by a slow increase after 72 hours. This could have been influenced by the change in cell culture method (from 2D to 3D) and the composition of the culture surface (from hydrophilic to more hydrophobic) relative to standard control conditions. In addition, the lack of a cell proliferation assay dedicated to porous and non-transparent 3D materials affects the correct analysis of interaction of the investigated materials with the cells.

Conclusions
The presented results indicate the need for further research for a detailed examination of the impact of native and modified polyurethane composites on the biological properties of mesenchymal stem cells.

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References
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