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ANALYSIS OF THE INTERACTION BETWEEN STEM CELLS AND 3D PRINTED SCAFFOLDS FOR TISSUE REGENERATION

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Tissue engineering is a branch of regenerative medicine and is based on the utilization of biomaterials combined with cells and other bioactive molecules to regenerate functional tissues. Biomaterials scaffolds are used to reproduce the extracellular matrix and they also act as substrate and physical support for cells, orienting the formation of the new tissue. Even though the technique is promising and has already allowed the construction of whole organs in labs, its use in human patients is still limited. This is due to the challenge of finding materials and implantation techniques that can substitute living tissues in an adequate manner, giving that the physical and biological characteristics of living tissues are the result of millions of years of evolutionary optimization. Currently, several studies have already demonstrated that cells interact well with different biomaterials, but these results are not comparable, given the fact that they use different cell types, different materials and different analyses' techniques. Therefore, it is still necessary to understand how cells and other biological factors involved in the process of tissue formation interact with the biomaterials in order to obtain a reliable comparison and decide which biomaterials are more adequate to mimic the intrinsic properties of the living tissue. The choice of biomaterials also takes into account their biocompatibility, biodegradability and the presence of physical properties similar to the biological tissue. Other important factors that influence the cells' response are the porosity of the scaffold, the size and interconnectivity of these pores and the composition of the scaffold's surface. In this work, we are initially analyzing the interaction between different types of biomaterials and endothelial and mesenchymal stem cells in order to understand how the cells behave on the scaffolds. Because polylactic acid (PLA) is the most common biomaterial tested for tissue regeneration, we selected it to perform the initial tests to determine ideal format and pore size and analyze cell adherence. The scaffolds were fabricated at Universidade Tecnológica Federal do Paraná (UTFPR) using a 3D printer. For the first tests, we had two different scaffolds - one was cubic (10mmx10mmx3mm) and the other was cylindrical 14,5mm(d)x5mm(h). Scanning electron microscopy was used to observe cell adherence on the scaffolds after 8 days in culture. Also, through fluorescence microscopy we had an indication that cells had not only adhered but had also proliferated. Our perspective is to determine cell proliferation and analyze the possible effects of different scaffolds in cell behavior considering its ultrastructure, adherence and proliferation. Once we determine the parameters for the scaffold manufacture, we will select novel biomaterials to compare and better understand how they interact with stem cells for future possible applications in tissue regeneration.