Tissue Engineering Using Nanofibers as Scaffolds: The Effects of Electrospinning on Stem Cell Viability

Patricia Pranke 1, Geancarlo Zanatta 1,2, Daniela Steffens 1, Daikelly I. Baghirolli 1, Raquel A. Fernandes 1 and Carlos A. Netto 2

Corresponding Author: patriciapranke@ufrgs.br

1 Hematology and Stem Cell Laboratory, 2 Cerebral Ischemia Laboratory, Department of Biochemistry, Federal University of Rio Grande do Sul; 3 Conceição Hospital Group, Porto Alegre, Brazil.

Introduction

One of the main goals of tissue engineering is to associate cells with biomaterials in order to immitate the extra cellular matrix. Electrospinning is a method used to create nanofibres and is commonly employed to develop fibrous scaffolds. In this study we tested a different approach for producing scaffolds or matrix with cells, where the polymeric solution was mixed with the cells before the electrospinning process.

Materials and Methods

Mesenchymal stem cells were extracted from the umbilical cord itself and were then characterized as stem cells due to their capacity of differentiating into adipogenic, osteogenic and chondrogenic lines and also due to the presence of immunophenotypic markers for mesenchymal stem cells. Mononuclear cells were collected from the umbilical cord blood. The two types of cells were re-suspended in 10% PVA polymer and, following that, used to evaluate the viability of the cells after electrospinning. The nanofibres were produced using an electrical potential of 21kw and evaluated by optic microscopy, scanning electron microscopy and confocal analysis to observe the morphology of the fibers and the presence of cells in the scaffolds. Cellular viability was verified by exclusion of dead cells by Trypan Blue staining. Homogeneous data was obtained by raising the values to the power of 0.3 (X0.3). Analysis of Variance was followed by post hoc Tukey tests and p equal or less than 5% were considered significant.

Results

We obtained an average viability value for the mesenchymal stem cells of 19.6%, and the average viability value for the mononuclear cells was 8.38% (figure 1).

Discussion and Conclusions

Despite cell viability reduction, 19.6% of stem cell viability can be considered sufficient for use in tissue engineering or for future studies with the aim of improving the viability of the cells. These results suggest that the cells can maintain certain levels of viability when processing them with this technique, which makes this method attractive for its use in tissue engineering.

References


Acknowledgments

CNPq for the financing of the project

Disclosures

The authors declare that they have no conflict of interests.