World Academy of Science, Engineering and Technology
International Journal of Biomedical and Biological Engineering
Vol:18, No:05, 2024

Developing Scaffolds for Tissue Regeneration using Low Temperature Plasma (LTP)

Authors : Komal Vig

Abstract : Cardiovascular disease (CVD)-related deaths occur in 17.3 million people globally each year, accounting for 30% of all deaths worldwide, with a predicted annual incidence of deaths to reach 23.3 million globally by 2030. Autologous bypass grafts remain an important therapeutic option for the treatment of CVD, but the poor quality of the donor patient's blood vessels, the invasiveness of the resection surgery, and postoperative movement restrictions create issues. The present study is aimed to improve the endothelialization of intimal surface of graft by using low temperature plasma (LTP) to increase the cell attachment and proliferation. Polytetrafluoroethylene (PTFE) was treated with LTP. Air was used as the feed-gas, and the pressure in the plasma chamber was kept at 800 mTorr. Scaffolds were also modified with gelatin and collagen by dipping method. Human umbilical vein endothelial cells (HUVEC) were plated on the developed scaffolds, and cell proliferation was determined by the 3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyl tetrazolium bromide (MTT) assay and by microscopy. mRNA expressions levels of different cell markers were investigated using quantitative real-time PCR (qPCR). XPS confirmed the introduction of oxygenated functionalities from LTP. HUVEC cells showed 80% seeding efficiency on the scaffold. Microscopic and MTT assays indicated increase in cell viability in LTP treated scaffolds, especially when treated with gelatin or collagen, compared to untreated scaffolds. Gene expression studies shows enhanced expression of cell adhesion marker Integrin- α 5 gene after LTP treatment. LTP treated scaffolds exhibited better cell proliferation and viability compared to untreated scaffolds. Protein treatment of scaffold increased cell proliferation. Based on our initial results, more scaffolds alternatives will be developed and investigated for cell growth and vascularization studies. Acknowledgments: This work is supported by the NSF EPSCoR RII-Track-1 Cooperative Agreement OIA-2148653.

Keywords : LTP, HUVEC cells, vascular graft, endothelialization
Conference Title : ICBE 2024 : International Conference on Biomedical Engineering
Conference Location : Sydney, Australia
Conference Dates : May 16-17, 2024

Open Science Index, Biomedical and Biological Engineering Vol:18, No:05, 2024 publications.waset.org/abstracts/173814.pdf