Improving Safety of Major Liver Surgery by augmentation of Liver function using Biocompatible Scaffolds with Hepatic Progenitor Cells

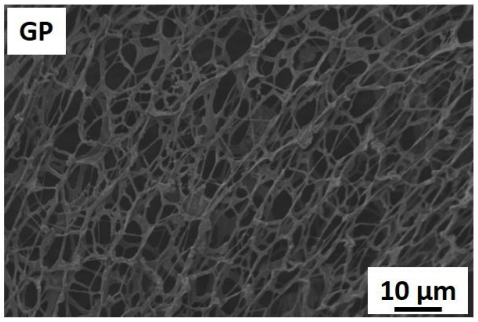
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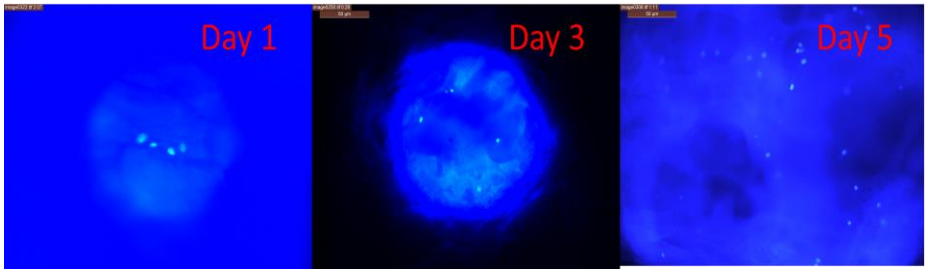
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The aim of the study is to synthesize a novel biocompatible, biodegradable scaffold, which allows the proliferation of hepatocytes while maintaining its functional phenotype. The Scaffolds synthesised have the spatial arrangements that mimics the in vivo Liver Extracellular Matrix (ECM) thereby endowing the biomechanical cues that aids in proper cell-cell and Cell- ECM interactions. Collagen and polyvinyl Alcohol (PVA) has been used for fabrication of the scaffold. Collagen is an insoluble fibrous protein which constitutes 90% of Liver ECM blended with PVA, a synthetic polymer to enhance the mechanical strength of the Scaffold. The high porous nature of the scaffold enables rich nutrient supply, high oxygen diffusion and effective excretion of bile. Physical Characterization of the scaffold was done using Scanning Electron Microscope (SEM), Fourier Transform Infrared Spectroscopy (FTIR), and swelling, Contact Angle, Thermogravimetric Analysis (TGA) and Mechanical Studies (Stress and Strain). Biologically the scaffold was tested for Haemolysis, Protein absorption and proliferation index of the cells in the Scaffold was indirectly measured with MTT (3-(4, 5-Dimethylthiazol-2-yl)-2,5-Diphenyltetrazolium Bromide). The Scaffold supports the growth of both Stem cells and pre-differentiated hepatocytes. The stem cells are isolated from infrapatellar fat pad and differentiated into hepatocytes using minimal growth factors. The cells were characterized in a stage-wise manner to ensure it moves towards definitive endoderm and then to hepatocytes. Live/dead cell assay in the scaffold was carried out with Acridine Orange/Propidium iodide staining (AO/PI). Further vascularization studies in vivo rat models would be conducted before it can be used as a potent biomaterial for liver regeneration.

Keywords: Scaffold, Physical cues, stem cells, regeneration



SEM image of the scaffold on which heaptocytes were seeded



Hepatocyte on scaffolds stained with DAPI

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