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Preparation of PLGA nanofiber scaffold in tissue engineering using electrospinning technique

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Background and Aims: An important characteristic of electrospinning is the ability to make fibers with diameters in the range of nanometers to a few microns. Consequently these fibers have a large surface area per unit mass. These fibers can be used for example, for biomedical applications, such as wound dressing in medical industry, tissue engineering scaffolds and artificial blood vessels.
Methods: PLGA polymer solutions in chloroform:THF (4:1) organic solvent was prepared in 6 different concentration (9%, 10%, 11%, 12%, and 13%). Solution was filled in 21 gauge needle syringe and used in electrospinning apparatus. Voltage range was varying between 8-13 kv. The distance to collector plate was fixed at 15 cm and flow rate was kept constant at 0.5 ml/hr. Tetra Ethyl Ammonium Bromide (TEAB) organic salt was used in polymer solution in concentration of 0.8% w/v to increase conductivity of electrospinned solution. Obtained nanofibers morphology was evaluated using scanning electorn microscopy (SEM) and fiber diameter was calculated using Image Analysis Software. Cell attachment to the scaffold and its viability was assessed using fibroblast stem cell culture on fabricated scaffold.
Results: Higher concentration of polymer solution resulted in more homogenous fibers, a 12% w/v concentration seemed to be optimum and all fiber diameters were below 200 nm. Higher concentration leads to high viscosity and non reputable rheologic behavior and also it thickens the fiber diameter. Incorporated TEAB salt disappeared the existed beads in nanofibers and showed no toxicity for stem cells. Cultured cells were entirely attached to the scaffold after a 18 hours incubation in 37’C temperature and 5% Co2.
Conclusions: This study confirms the tremendous potential of electrospinning technology in fabrication of polymeric scaffolds with desirable morphology and physicochemical characteristic which can be utilized in tissue engineering field.

Keywords: Tissue engineering; Electrospinning; PLGA; Nanofiber