63° SIMPOSIO AFI RIMINI 5·6·7 GIUGNO2024

Associazione Farmaceutici Industria Società Scientifica

TITOLO (maiuscolo)

Autore (i)

Ente di appartenenza

Riassunto

Carattere: ARIAL
Corpo: 10
Interlinea: 1

A PRELIMINARY STUDY OF PEPTIDE DECORATED ELECTROSPUN SCAFFOLDS AS VASCULAR GRAFTS

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Cardiovascular diseases (CVDs) including coronary heart disease, deep vein thrombosis, and myocardial infarction are still major public health problems, and it is estimated that CVDs caused more than 3.8 million people death in Europe per year. Surgical attempts such as bypass grafting are mostly imposed treatment method for CVDs. Tissue-engineered synthetic vascular grafts (VGs) are direly needed in vascular surgeries despite autologous grafting challenges since their sources and uses are limited and, weaken mechanical and blood flow ability. Moreover, allogenic blood vessels are associated with potent immune responses. Electrospinning method enables the flexibility of manufacturing biocompatible polymer based synthetic VGs with desired length, diameter, mechanical properties, surface modification, and extracellular matrix mimicking environment beside on providing a large surface area for remodelling. Biomimetic small peptides pay the way of functionalized electrospun VGs by surface crosslinking strategies with several purposes (e.g. angiogenesis, cell proliferation and differentiation or anticoagulation). Currently, small diameter synthetic VGs are limited because of low-rate patency and mismatch of mechanical compliance. This work is addressed to develop a biocompatible electrospun scaffold with surface functionalization by several biomimetic peptides. As a preliminary study, a biomimetic peptide, CGFOGER, which is known to promote cell adhesion, proliferation, and differentiation was synthesized by solid phase peptide synthesis. CGFOGER peptide was characterized with mass spectroscopy and high liquid chromatography (HPLC) revealing purity of 99%. Poly(lactic-co-glycolic acid)(PLGA; LG 50:50,66 kDa) was used to manufacture electrospun fibers to take advantage of its biocompatibility and surface chemistry for peptide surface modification. Electrospinning parameters and polymer properties were optimized. 25% (w/v) PLGA solution in HFIP, were electrospun by 15 kV electrical voltage at 0.1 ml/hours flow rate keeping the collector-syringe tip distance at 150 mm. Scanning electron microscopy (SEM) confirmed the fibrous structure. After that, PLGA fiber surface modified to prepare the surface for peptide immobilization. Peptide immobilization was performed in PBS (pH: 7,4) by Michael addition. Peptide immobilization was evaluated by HPLC. SEM images revealed random oriented, continuous, and bead-free PLGA fibers with a 2958±246 nm average diameter. Preliminary HPLC results showed that 15nmol CGFOGER peptide is immobilized on PLGA surface indicating that 18.2% of PLGA is functionalized. This finding suggests that anchoring biomimetic small peptides on electrospun fibers is encouraging strategy to minimize limitation of vascular of small vascular grafts. Further research will be focused on the biological behaviour of functional grafts.

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