ABSTRACT

Platelet derivatives are an attractive source of natural growth factors and they are widely used in various tissue engineering and regenerative medicine applications.

The aim of this study was to optimize cell culture conditions using platelet lysate and to develop platelet-functionalized fibrous scaffolds as a controlled drug delivery system for native growth factors. Fibrous scaffolds were prepared by electrostatic and centrifugal spinning of PCL and they were functionalized by the platelets by surface adhesion or their encapsulation using emulsion spinning techniques.

The cell culture study determined the 7% platelet lysate to be the optimum concentration as a medium supplement in keratinocyte and fibroblast culture. Additionally, following surface adhesion of the platelets to PCL electrospun nanofibres, the platelets were activated due to their contact with the nanofibre nanotopography, resulting in formation of fibrin network. Fibrin served as a reservoir of the growth factors, prolonging the half-time of EGF release to 1.7 days. Such platelet-functionalized samples fostered proliferation of keratinocytes, fibroblasts and melanocytes. Furthermore, adhesion of platelets to centrifugally spun nanofibrous scaffolds resulted in almost two-fold increase in the amount of immobilized platelet-derived bioactive molecules, further promoting metabolic activity of the seeded melanocytes. Thanks to encapsulation of the platelet lyophilisate into emulsion electrospun and centrifugal spun coaxial nanofibres, a drug delivery system enabling long-term delivery of platelet-derive biomolecules was developed and optimized. The system was successfully tested in vitro using keratinocytes and fibroblasts, however, its versatility suggests broader application.