Mesenchymal stem cells associated with chitosan scaffolds loaded with rosuvastatin to improve wound healing

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Abstract

In this study we explored the role of rosuvastatin calcium in skin regeneration as statins play important role in the field of tissue engineering. Chitosan hydrochloride was crosslinked with different weight ratios of collagen, β-glycerolphosphate and carboxymethyl cellulose to produce scaffolds by lyophilization technique. Subsequently, the fabricated scaffolds were examined for their morphology, water absorption capacity, water retention, friability and in-vitro drug release as well as in-vivo studies. The results revealed porous 3-D structured scaffolds with maximum water absorption values-ranging between 396 and 2993%. Scaffolds containing carboxymethyl cellulose revealed highest water absorption-values. In-vitro drug release results showed gradual drug release for 60 h with mean dissolution time-values (MDT) between 13 and 21 h. Combination of chitosan, collagen, carboxymethyl cellulose in weight ratio of 40:30:30, respectively achieved gradual disintegration of the scaffold in a simulating medium to an open wound after 4 days. This selected scaffold loaded with rosuvastatin revealed increase proliferation of human dermal fibroblasts compared to placebo scaffold. After 30 days of implantation of selected medicated scaffold loaded with/without mesenchymal stem cells and placebo scaffolds to induced wounds in Albino rats, enhanced skin regeneration and absence of scar formation for drug loaded scaffolds were observed. The histopathological study showed the advantage of stem cells-loaded scaffolds through the normal redistribution of collagen in the epidermal layer. In conclusion, rosuvastatin calcium and stem cells loaded in the tested scaffolds proved their potential effect in enhancing skin healing and regeneration.

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