Norfloxacin-loaded collagen/chitosan scaffolds for skin reconstruction: Preparation, evaluation and in-vivo wound healing assessment

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Abstract

Biomaterial scaffolds are versatile tools as drug carrier for treatment of wounds. A series of norfloxacin-loaded scaffolds were synthesized for treatment of wounds by combining collagen with two different types of chitosan using freeze-drying technique. Subsequently, scaffolds were screened in terms of morphology, water absorption and retention capacity, biodegradation, ex-vivo bioadhesive strength, in-vitro drug release biological compatibility, X-ray diffractometry, differential scanning calorimetry as well as in-vivo evaluation. The results indicate that the scaffold mechanical strength is dependent on the type of used chitosan. The prepared scaffolds contained interconnected porous architecture. The scaffolds had high water uptake and retention capacity with extended biodegradation rate. Scaffolds prepared with chitosan HCl showed superior bioadhesive strength compared to those prepared with low molecular weight chitosan. All scaffolds showed almost 100% drug release within 24 h. As identified by the terahertz pulsed imaging measurements, there is single scaffold area with the same concentration. After 28 days of wound dressing with selected norfoloxacin-loaded or unloaded collagen/chitosan scaffolds in Albino rats, it was found that the tissue regeneration time was fast compared to non-treated wounds. Furthermore, the drug-loaded scaffolds showed normal structure of an intact epidermal layer as well as the underlying dermis as revealed by histopathological studies. The obtained results suggest that the investigated norfloxacin-loaded collagen/chitosan scaffold is a potential candidate for skin regeneration application.

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