Self-assembled peptide hydrogels as scaffolds for wound healing

Authors:

Mélanie Côté-Cyr, Phuong Trang Nguyen and Steve Bourgault

Affiliations:

Department of Chemistry, Université du Québec à Montréal, C.P. 8888, Succursale Centre-Ville, Montreal H3C 3P8, Canada;

Quebec Network for Research on Protein Function, Engineering and Applications (PROTEO), Montreal, Canada;

The Center of Excellence in Research on Orphan Diseases – Fondation Courtois (CERMO-FC), Montreal, Qc, H3C 3P8, Canada

In Canada, it is estimated that 30 to 50% of all healthcare involves wounds. Specifically, chronic wounds critically affect living conditions of patients and add to the burden on healthcare systems. Matrices and hydrogels have emerged as promising treatment options, acting as scaffolds for cells and delivery systems for therapeutic agents. Self-assembled peptide-based matrices have attracted great interest owing to their biocompatibility, degradability, robustness and low immunogenicity. In this study, we aim to produce fully synthetic peptide-based matrices functionalized with bioactive sequences for wound healing. The I10 synthetic peptide, known to assemble into cross-β-sheet fibrils, was functionalized with cell-adhesion (PRa), cell migration-promoting (FGF2) or antimicrobial (IG19) sequences. All I10-based peptides individually self-assembled into β-sheet- and β-turn-rich fibrils, as observed by circular dichroism (CD) spectroscopy and atomic force microscopy (AFM). Coassembly of the functionalized peptides with a charged version of I10 (K-I10-COOH) allowed formation of hydrogels containing both β-sheet- and β-turn-rich fibres, as confirmed by CD spectroscopy, AFM, and scanning (SEM) and transmission (TEM) electron microscopy. These peptide assemblies showed good adhesion properties for skin cells, including keratinocytes (HaCaT) and fibroblasts (1BR3, L929), encouraging further evaluation of cell migration properties, antimicrobial activity and healing potential in a mouse full-thickness wound model.