Recombinant thrombomodulin-embedded biodegradable hydrogels accelerated chronic wound healing

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Thrombomodulin (TM) is a type-I transmembrane glycoprotein that is expressed on the surfaces of endothelial cells and epidermal keratinocytes. It is known to regulate blood coagulation, inflammation, and cell-cell adhesion. A recombinant TM, which contains an epidermal-like domain and serine/threonine-riches domain, has been demonstrated to stimulate cell proliferation and migration of keratinocytes and wound healing. The objective of this study was to prepare and characterize rhTM-embedded hydrogels which would be biodegraded within 3 days for the treatment of chronic wound. The properties of rhTM biodegradable hydrogels such as drug loading efficiency and release profile were investigated and analyzed with an ELISA assay. The long-term stability of the rhTM hydrogels was assessed. The effectiveness of the rhTM-loaded hydrogels was evaluated using a full-thickness wound model in streptozotocin-induced diabetic mice.

The results demonstrated that natural-biodegradable-materials-based hydrogels can slowly release rhTM in a short term and remain stable after long-term storage. The once every-3-day rhTM-loaded hydrogels markedly promoted wound healing and were superior to rhTM solution, once daily rhTM hydrogel and hydrogel control treatment groups. The rhTM hydrogels enhanced re-epithelialization, collagen deposition, and angiogenesis in wound repair. The rhTM hydrogels were stable after 11-month of storage at 4°C. The developed hydrogels meet the needs for clinical practice, and may have future medical applications for wound care in diabetic patients.