URN etd-0407109-183709-697
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Author's Email Address No Public.
Statistics This thesis had been viewed 42 times. Download 108 times.
Department
Year 2005
Semester 1
Degree Master
Type of Document Master's Thesis
Language zh-TW.Big5 Chinese
Title Stimulation of wound healing by PU/hydrogel composites containing fibroblast growth factor-2

Date of Defense 0000-00-00
Page Count 67

Keyword
Polyurethane (PU); N-isopropyl acrylamide (NIPAAm); Acrylic acid (AAc); Hydogel;Fibroblast growth factor-2(FGF-2); γ-ray; Wound

Abstract
In this study, Polyurethane (PU)/hydrogel composites were fabricated for wound repair applications. The hydrogel was copolymer of thermosensitive N-isopropyl acrylamide (NIPAAm) and acrylic acid (AAc). γ-ray irradiation was employed to copolymerize NIPAAm with AAc and to graft hydrogel onto porous PU simultaneously. Fibroblast growth factor-2 (FGF-2) was incorporated into the composite to facilitate the wound healing. The physical properties of composites were characterized, their in-vitro release of FGF-2, and in-vivo tests were conducted. Some of these results were compared with those obtaining from the commercial wound dressing (TegadermTM, 3M Health Care, Neuss, Germany). The results indicate that porous PU not only provided moderate mechanical strength of composite but also minimized the water vapor transmission due to its hydrophobic nature. Thermosensitive hydrogel could absorb most of the wound exudates due to its high water uptake ability. Since its thermosensitive property, PU/hydrogel composite was easier to strip off than that of commercial wound dressing, this prevents from the second injury of wound when replacing the wound dressing. The water vapor transmission rate (WVTR) of the PU/hydrogel was found to be 3340±164 g/m2/day indicating that it can maintain a moist environment over wound bed in moderate to heavily exuding wound which would enhance epithelial cell migration during the healing process. In vivo results showed that the PU/hydrogel composite incorporating FGF-2 could accelerate wound healing and reduce the scar formation. On the other hand, the commercial wound dressing was unable to absorb wound exudates and not easily to strip off; therefore the speed of wound healing was slow and the second injury of wound could not prevent. The hematoxyline & eosin (H & E) stain from repair wound healing by PU/hydrogel composite incorporating FGF-2 revealed the obvious migration of epithelial cells at day 2, while the time for the other groups (control, FGF-2 only, PU/hydrogel composite only, and commercial wound dressing) was extended to day 4. In summary, the PU/hydrogel composite incorporating FGF-2 as a wound dressing was able to effectively interact with the wound in a suitable moist healing environment. Moreover, these composites were prepared byγ-ray irradiation which does not need any chemical additives, thus reducing the toxicity of the products and making them more compatible with skin.
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Date of Submission 2006-08-22