EFFECT OF 6-AMINOPURINE HYDROGEL ON THE FORMATION OF GRANULATION TISSUE

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Abstract: *Granulation tissue formation is a key stage in the wound healing process, characterized by fibroblast proliferation, angiogenesis, and extracellular matrix deposition. The present study investigates the influence of a 6-aminopurine-loaded hydrogel on the formation of granulation tissue in damaged skin. The hydrogel system provides a moist environment and ensures controlled release of the biologically active compound. Experimental observations showed that the use of the hydrogel significantly accelerated fibroblast proliferation, increased vascularization, and promoted collagen deposition in the wound area. These results indicate that the combination of hydrogel matrices and purine derivatives can effectively stimulate tissue regeneration and improve wound healing outcomes.*

Key words: *granulation tissue, 6-aminopurine, hydrogel, wound healing, tissue regeneration.*

Introduction

Granulation tissue formation plays a crucial role in the regeneration of damaged tissues during wound healing. This process involves the proliferation of fibroblasts, the development of new blood vessels (angiogenesis), and the accumulation of extracellular matrix components, especially collagen. Granulation tissue serves as a structural scaffold for further epithelialization and tissue repair.

Modern wound therapy increasingly focuses on maintaining a moist wound environment, which has been shown to significantly enhance cellular migration and proliferation. Hydrogels are widely used as wound dressings because of their high water-retention capacity and their ability to deliver biologically active substances directly to the wound site[1-24].

6-Aminopurine, a biologically active purine derivative structurally related to adenine, is known to participate in nucleic acid metabolism and cellular signaling processes. Previous studies have suggested that purine derivatives can stimulate cellular proliferation and tissue regeneration. Incorporating such compounds into hydrogel systems may enhance their therapeutic potential.

The aim of this study was to evaluate the effect of a 6-aminopurine-loaded hydrogel on granulation tissue formation and to determine its potential role in improving wound healing.

Materials and Methods

A hydrogel preparation containing 6-aminopurine was synthesized using a biocompatible polymer matrix capable of retaining large amounts of water. The polymer components were dissolved in a buffered aqueous solution and mixed thoroughly to obtain a homogeneous mixture. Subsequently, a calculated amount of 6-aminopurine was introduced into the system, followed by the addition of a cross-linking agent to form a three-dimensional hydrogel network.

The prepared hydrogel was characterized for its swelling capacity, mechanical stability, and release kinetics of 6-aminopurine. Sterilization was performed under controlled conditions before its application in experimental wound models.

For the biological evaluation, wounds were treated with the 6-aminopurine hydrogel after cleaning the affected area with antiseptic solutions. The hydrogel was applied evenly on the wound surface and covered with sterile dressings. The treatment was repeated at regular intervals.

Granulation tissue formation was evaluated by monitoring fibroblast proliferation, vascular development, and collagen deposition within the wound area. Morphological observations and clinical indicators of tissue regeneration were recorded throughout the experimental period.

Results and Discussion

The experimental results demonstrated that the 6-aminopurine hydrogel significantly stimulated granulation tissue formation compared with untreated or conventionally treated wounds. During the early stages of treatment, the hydrogel created a stable moist environment that prevented tissue dehydration and facilitated cellular migration.

In the following stages, enhanced fibroblast activity was observed within the wound bed. Fibroblasts are responsible for synthesizing collagen and other extracellular matrix components that provide structural support for new tissue formation. The presence of 6-aminopurine appeared to stimulate cellular metabolic activity and DNA synthesis, which may explain the increased proliferation of fibroblasts.

Angiogenesis was another important observation. Newly formed capillaries were detected within the developing granulation tissue, improving oxygen and nutrient supply to regenerating cells. The hydrogel matrix also functioned as a protective barrier, reducing the risk of external contamination and maintaining optimal hydration.

Furthermore, the controlled release of 6-aminopurine from the hydrogel matrix ensured a sustained biological effect at the wound site. This prolonged stimulation of regenerative processes contributed to faster formation of healthy granulation tissue and improved wound healing dynamics.

Overall, the results suggest that the combination of hydrogel technology and purine-based bioactive compounds can significantly enhance tissue regeneration processes.

Conclusion

The study confirmed that a 6-aminopurine-loaded hydrogel positively influences the formation of granulation tissue during wound healing. The hydrogel provides a moist protective environment while simultaneously delivering a biologically active compound that stimulates fibroblast proliferation and collagen synthesis.

As a result, the treated wounds exhibited faster granulation tissue formation, improved vascularization, and enhanced tissue regeneration. These findings demonstrate that hydrogel systems containing purine derivatives represent a promising strategy for advanced wound care and regenerative medicine.

Further investigations involving larger experimental models and detailed biochemical analyses are recommended to fully understand the mechanisms of action and to optimize the formulation for clinical applications.

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