Abstract

Subject: Evaluation of the effect of oxidized poly-lysine/carboxymethyl cellulose hydrogel loaded with allantoin to accelerate wound healing

Introduction: The skin is the largest and most important organ and protects the body against external damage. Despite their ability to reproduce, severe skin defects such as wounds do not heal by themselves and require adjuvant treatments. Wounds are one of the most common skin treatment problems that are not treated using existing methods and must be repaired by alternative treatment methods. In recent years, many advances have been made in the field of wound healing based on new biological materials. In the meantime, hydrogels are one of the things that can mimic the skin's biological environment due to their unique structural properties and high similarity with the extracellular matrix. Studies have shown that hydrogels can be used as permanent or temporary wound dressings to repair and regenerate skin damage caused by various wounds. Therefore, by taking advantage of the excellent properties of hydrogels, in this study, a hydrogel wound dressing was prepared on oxidized poly-lysine/carboxymethyl cellulose and loaded with allantoin.

Materials and methods: In order to prepare hydrogel, oxidized carboxymethyl cellulose and highly branched polylysine polymer were prepared separately. Then poly-lysine/carboxymethyl cellulose oxidized hydrogel containing allantoin anti-inflammatory compound was prepared through Schiff base reaction. Similarly, in order to perform animal tests, gelatin polymer was added to the final hydrogel structure. The physicochemical properties of the resulting hydrogel were investigated by transmission infrared spectroscopy (FTIR), X-ray diffraction (XRD) and thermal gravimetric analysis (TGA). Also, allantoin release, cytotoxicity and antibacterial effects of hydrogel were evaluated. Finally, the therapeutic effect of hydrogel on wound healing in an animal model was studied and evaluated.

Results: The results of FTIR, XRD and TGA tests confirmed the formation of hydrogel and drug loading inside the hydrogel. The results of the cytotoxicity test showed that the hydrogel is not toxic to the cells. Likewise, the colony count test results confirmed that the prepared hydrogel has good antibacterial properties. The findings of animal studies showed that hydrogel has a significant effect on animal wound healing.

Conclusion: The results of this study showed that the prepared hydrogel has good antibacterial properties, is biocompatible, and in addition to controlling drug release, hydrogel improves wound healing.

Keywords: Wound healing, Hydrogel, Polylysine, Carboxymethyl cellulose, Allantoin