

Abstract

Tissue regeneration is a typical physiological healing response to the damaged tissue to recuperate its normal functionality. Wound healing is now a challenging global clinical problem where fibroblasts, microvascular cells, keratinocytes, and immune cells play a major role. Many types of antimicrobial and moisturized wound dressings are being developed with a variety of features to heal the wound. This study has been designed to prepare the silver nanoparticles (AgNPs) based hydrogels in combination with the L-Tyrosine and L-Tryptophan amino acids to accelerate the tissue regeneration process. The conjugation of amino acids with the AgNPs was confirmed by UV-Vis spectroscopy and Fourier transform infrared spectroscopy (FTIR). A biopsy punch (6mm) was used for the excision of experimental wounds. The tissue regeneration potential of AgNPs individually and in combination with the L-Tyrosine and L-Tryptophan amino acids was evaluated by estimating the wound contraction percentage, serum proteins analysis, biochemical tests and histological examination. The AgNPs hydrogel in combination with the L-Tryptophan amino acid showed a good healing potential in which wounds were healed in 12 days (Percent wound contraction Mean \pm SE: 83.26 ± 0.66) than that of wounds treated with the pure C-AgNPs hydrogel, L-Tyrosine AgNPs hydrogel, and Polyfax (Positive control) respectively (Percent wound contraction Mean \pm SE: 67.20 ± 0.51 , 67.52 ± 0.93 , and 51.46 ± 0.70). The level of serum proteins significantly increased ($P < 0.001$) in different treatment groups as compared to control groups. Catalase, and GST level significantly decreased, while SOD level significantly increased in L-Tryptophan AgNPs hydrogel as compared to control groups as well as to other treatment groups. Histological examination also showed that wounds covered with L-Tryptophan AgNPs hydrogel have better wound healing capacity than Polyfax and other treatment groups. These findings support our hypothesis that amino acid-capped silver nanoparticles based hydrogels can be a strong contender for an efficient wound care and management.

Keywords: Silver nanoparticles, amino acids, wound healing, hydrogels, wound contraction, and wound dressing, serum proteins