The effect of superoxide dismutase-contained nanostructured lipid carriers on second-degree burn wound healing in rat: an In-vivo study

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Abstract

Introduction

Superoxide dismutase enzyme (SOD) with high antioxidant activity and, by controlling oxidative stress and reducing the activity of free radicals like ROS, reduces injury and accelerates healing. NLCs were used as the main formulation due to their small particle size, better permeability, higher shelf-life and etc. The purpose of this study was to investigate the effect of nanostructured lipid carriers (NLC) on SOD activity in burn wound healing.

Method:

27 rats were divided to 3 groups: target, positive and negative control. Formulations were examined for particle size, enzyme activity and loading. Each formulations were used for 21 days on rats and at the end of each week they were examined by macroscopic and microscopic Methods. Each group was given a score based on the histology characteristics.

Results:

Physicochemical properties showed that the particle size was between 35 and 85 nm, and the percentage of enzyme loading was 78% and the enzyme activity was 39.3% in the formulation of NLC+ENZ. Macroscopic examination showed that the best recovery rate was in the target group (NLC+ENZ) and showed better performance on the second and third weeks (p_{val}=0.029 in day 14 and p_{val}=0.000 in day 21). In pathological studies also shown that the angiogenesis and granulation tissue of the target group has a significantly better performance.

In Granulation scores first week NLC+ENZ P_{val} = 0.003

In Granulation scores second week NLC+ENZ P_{val} = 0.001

In angiogenesis scores first week NLC+ENZ P_{val} = 0.000

Conclusion:

This study showed that the formulation of the prepared nanoparticles had an acceptable enzymatic activity and loading percentages. The formulations of NLC+ENZ in comparison to the other two groups shows significantly improvement of pathologic factors, particularly angiogenesis, granulation tissue, and a faster reduction of inflammatory cells.

Key words: Topical drug targeting, Superoxide dismutase, Solid lipid nanoparticles, Second-degree burn, Reactive oxygen species