In vitro wound-healing effects of biosynthesized copper nanoparticles

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ARTICLE INFO

Article history:
Available online 25 November 2015

Keywords:
Biosynthesis
Copper nanoparticles
HaCat
Wound healing

Copper, the magical element, has been reported for centuries due to its significant role in the treatment of skin ailments. Copper is an essential element to our body and is known to possess antimicrobial, anti-inflammatory and angiogenetic properties. Hence, it makes it useful in wound healing [1]. In the present study we evaluated biosynthesized copper nanoparticles (BCuNps) for their wound-healing potential [2]. The objective of this study was to evaluate wound-healing potential of BCuNps by in vitro studies. Antimicrobial activities of BCuNps and copper sulphate were compared against Escherichia coli, Bacillus subtilis, Pseudomonas aeruginosa and Staphylococcus aureus by agar diffusion and broth dilution methods. HaCat (human skin keratinocytes) cells were used for assessment of wound-healing activity of BCuNps. The cells were cultured and maintained in DMEM and Ham F12 medium (1:1) supplemented with 10% foetal bovine serum. The CTC50 (concentration of drug required to kill 50% of exposed cells) of BCuNps was determined by MTT assay. For further studies, concentrations below CTC50 were used. Copper native (ion) was used as control during studies. BCuNps were evaluated for cell proliferation assay, evaluation of cell migration by scratch wound assay [3], and anti-inflammatory effect by measuring the expression of COX-2.

BCuNps showed better antimicrobial effect and were found to be highly effective against Gram positive bacteria, viz., B. subtilis (≤6.25 μg/ml > 3.125 μg/ml) and S. aureus (≤50 μg/ml > 25 μg/ml). The CTC50 values of BCuNps were slightly higher, 31 μg/ml, when compared to copper native (28 μg/ml). BCuNps enhanced the rate of cell proliferation as compared to copper native. BCuNps showed better cell migration in scratch wound assay and healed the wound within 24 hours. RT-PCR studies of COX2 expression showed that BCuNps exhibited better anti-inflammatory activity than copper native. They suppressed the expression of COX-2 better than copper native at the same concentration. As compared to copper in its native form, BCuNps exhibited better wound healing activity. These BCuNps are innovative biopharmaceutical candidates.

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Peer review under responsibility of Shenyang Pharmaceutical University.
http://dx.doi.org/10.1016/j.ajps.2015.11.070
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Acknowledgement

We wish to acknowledge the authorities of the Manipal College of Pharmaceutical Sciences, Manipal University, Department of Science and Technology (DST) and All India Council for Technical Education (AICTE) Government of India for providing the necessary facilities to carry out the research work.

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Fig. 1 – Wound healing activity of BCuNps (A). Scratch wound assay for zero hour and 24 hour for BCuNps, copper sulphate and control. RT-PCR for COX-2 expression; Lane 1 – control cells; Lane 2 – BCuNps; Lane 3 – copper sulphate; Lane 4 – ladder (B).