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Development of novel silver and zinc nanobiocomposites by Mastic gum *(Pistacia lentiscus)* and impregnation on surgical sutures for accelerated wound healing: Characterization, Biological and Cytocompatibility studies

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Abstract

Background: Bacterial adherence to sutures is one of the main causes of surgical site infections. An antibacterial suture material with enhanced wound healing function may protect the surgical site from various microbial infections. Thus, the present study aimed to investigate the synergistic effect of biogenic metallic nanoparticles when combined with sutures for biomedical use.
Methods: In the present research, we developed Silver (Ag), and zinc oxide (ZnO) based surgical sutures for the accelerated wound healing. Sutures fabricated with biogenic metallic nanoparticles were intensively characterized using UV-Vis, FTIR, scanning electron microscopy (SEM), and X-ray diffraction (XRD) along with zeta sizer and its biological potential were assessed by *In-vitro* and *In-vivo* studies.
Results: Color change from transparent to dark, and infra-red spectra with Ag and ZnO-bond stretches at confirmed the synthesis of NPs. The XRD analysis revealed sharp peaks which indicates the crystalline structure of biogenic nanoparticles. These mastic gum based NPs coated sutures show excellent antioxidant activities confirmed by DPPH radical scavenging assay. The agar well diffusion method was used to check the antibacterial potential against selected bacterial strains that are commonly found in infectious wounds such as *Escherichia coli, Bacillus Subtilis, Proteus mirabilis, Staph aureus and Pseudomonas aeruginosa* and their zones of inhibitions were measured, indicated excellent antibacterial potential. *In-vitro* cytotoxicity by hemolytic assay along with mutagenicity by Ames assay exhibited no toxicity and no mutagenicity. These results showed that the synthesized mastic gum based nanobiocomposites are safe for impregnation into surgical sutures by dip coating method for surgical site application. The designed suture showed excellent wound healing potential in rabbits with rapid rate of epithelialization, wound contraction, mild inflammation and absence of any infection on the wounded site.
Conclusion: Conclusively, Coating the sutures with nanobiocomposites possess effective antibacterial capacity to surgical sutures besides providing biocompatibility and wound healing activity.

Key Words: *Nanomaterials, Wound healing, Anti-bacterial dressings, Sutures, Tissue regeneration*