Development and Characterization of Different Insulin Based Nanoformulations for Wound Healing Activity

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Insulin is a peptide hormone that plays multiple functions in our body, such as the control of inflammation, increase in cell differentiation, lipid and protein biosynthesis, etc., and controlling glucose levels in the blood through glucose metabolism. In this work, various insulin functionalized metallic nano-formulations were prepared and studied for their application. The explored nanoformulations of insulin are biocompatible, stable, helps in cell division and migration, and wound healing. The IAgNP showed enhanced *in vitro* cell migration in both diabetic and no diabetic conditions compared to controls. *In vivo* histology evaluation showed a significant decrease in the level of leukocyte infiltration, faster deposition of collagen, and rapid re-epithelization anti-inflammatory activity, which is beneficial in treating chronic wounds. The *in vivo* studies showed a rapid decrease in inflammatory (IL-6 and TNF-α) cytokines and increased anti-inflammatory (IL-10) cytokines. IZnQCs and ICuQCs showed specific receptor binding, bioimaging, and wound healing properties. In IZnQCs, both insulin and zinc showed a synergistic effect through targeting IR and phosphorylating the same. These novel formulations are helpful in the recovery of the wound and monitor the wound and generate hope for better management of wounds, epically diabetic conditions.

Keywords: Wound healing; Nanoformulation; Insulin; Diabetes; Diabetes foot disease; Inflammation regulation; Quantum cluster