



Sprayable biogenic Ag-collagen nanocomposites with potent antibacterial and antibiofilm activity for *Acinetobacter baumannii* infected wound healing under hyperglycemic condition

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ABSTRACT

Owing to their susceptibility to infection by drug-resistant bacteria, refractory wounds pose a formidable risk to the well-being of patients with diabetes and other immune-compromised conditions, and their management poses significant economic distress to the healthcare system, particularly in low and middle-income countries. Therefore, deployable interventions for rapid and effective management of such wounds are needed. In the present study, we report the processing of sprayable biogenic Ag-collagen nanocomposites (Ag-Col NCs) with cogent antibacterial and healing activity in *Acinetobacter baumannii* infected wounds under hyperglycemic conditions. Silver nanoparticles (Ag NPs) has been synthesized by using the plant extract of *Urginea indica* (*U. indica*), which was further used for the processing of Ag-Col NCs. Synthesized NCs were found to have notable broad spectrum antibacterial activity against clinically significant strains (*Acinetobacter baumannii*, *Staphylococcus aureus* and Methicillin-resistant *Staphylococcus aureus*) and appreciable biocompatibility towards RAW 264.7 and 3 T3 mouse fibroblast cell lines. The sprayable NC system was found to promote the wound healing activity in mouse model (Balb/c) not only in normal but also in hyperglycemic conditions. Our experimental findings suggest the potential of the Ag-Col NC spray in chronic wound management and an exploitable option in both clinical and personalized settings.

1. Introduction

Skin, the largest organ in the body is composed of an intricate network of three layers, epidermis, dermis, and hypodermis, and provides a physical barrier between the environment and the organism [1]. The coherence of healthy skin plays a critical role in maintaining the physiological homeostasis of the human body and thereby, protects against any detriment caused by mechanical stress or strain, infections, fluid imbalance, and thermal dysregulation [2]. Due to its unique positioning, skin is perpetually challenged by a wide variety of external factors and therefore, susceptible to trauma or wound. Presently,

cutaneous wounds are considered one of the formidable challenges in medical care, with \approx 300 million chronic and \approx 100 million traumatic wound patients globally, and they put a momentous burden on the healthcare systems, specifically in low and middle-income countries [3,4]. Additionally, with the rise in the global population of immunocompromised patients with type-II diabetics and peripheral vascular disease, the incidences of complicated chronic wounds may surge drastically [5]. Wound healing usually involves complex intra and intercellular mechanisms that depend on an intricate interplay between a number of highly regulated factors (such as multiple cell populations and extracellular bioactive molecules as soluble mediators) to work in

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