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Biosilk Bilayered Scaffold Application in Management of Thermal Burns Wound

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Abstract

Haemostasis, inflammation, proliferation, and remodelling are the steps that comprise the complex biological process of wound healing. Chronic wounds often remain static in the inflammatory stage of wound healing beyond the expected duration and resist healing. Biosilk or biomodified silk dressing is believed to aid in accelerating the wound healing process. The combination bio functionalised silk matrix with silver oxide and Centella asiatica, a medicinal plant with wound healing properties, has been found to be effective in managing chronic non-healing wounds.

Keywords: Biosilk, Scaffold, Thermal Burns, Wound Healing, Wound Management.

Introduction

Wounds healing is a complex biological process which comprises of haemostasis, inflammation, proliferation, and remodelling. Cells that are involved in this process include neutrophils, macrophages, lymphocytes, keratinocytes, fibroblasts, and endothelial cells.[1] A chronic wound is one that does not heal in the expected sequence and in a predictable length of time, or one that does not heal within three months.[2] Chronic wounds often remain static in the inflammatory stage of wound healing beyond the expected duration. The predominant issue that patients with chronic ulcers face is persistent pain. In the recent years, biological dressings have gained popularity and have been found to benefit patients with chronic wounds. One such dressing substance being explored is biosilk containing silver oxide and Centella asiatica, a medicinal plant. Its use is thought to enhance the wound healing process.

Materials and Methods

An 82 years old gentleman, with no comorbidities, presented with complaints of thermal burns of 35% BSA by cylinder blast. On examination of - Right lower limb: 2nd degree superficial to deep burns on the leg on the posterior aspect and on the lateral thigh with multiple blisters. On Admission Fig 1 and 2 - Wound at admission on the right thigh was noted, Fig 3 – Wound on 3rd day following admission on the right thigh. On day 3 of admission Biosilk was applied to the wound. Wound on 10th day of admission on the right thigh.

Figure 1: Wound With Before Biosilk Application Bjwat Score 36 At Admission on the Right Thigh.

Figure 2: Wound With Biosilk Application on 3rd Day Following Admission on the Right Thigh.

Figure 3: Wound Post Biosilk Application (Bjwat Score 28) On 10th Day of Admission on the Right Thigh.

Result

At the end biosilk dressing, there was accelerated wound healing noted of the raw area of right thigh with healthy granulation tissue.

Discussion

Wound healing to be adequate requires rapid haemostasis, appropriate inflammation. mesenchymal cell differentiation, proliferation, and migration to the wound site, angiogenesis, prompt re-epithelialization and proper synthesis, cross-linking, and alignment of collagen to provide strength to the healing tissue.[4] Growth factors such as transforming growth factor (TGF)- platelet-derived growth factor (GF), fibroblast growth factor (FGF), and epidermal growth factor (EGF) play a crucial role in facilitating the above-mentioned steps of wound healing.

The aim of this study was to explore the effects of use of biosilk in wound healing. The combination used here included silk, Centella asiatica extract, and silver oxide, each of which carry important properties that affect wound healing. Due to the unique properties of silk, such as, great mechanical strength, outstanding biocompatibility, and the capacity to modify the structural and morphological aspects of silk proteins, they represent a new class of sophisticated biomaterials. It has proven to be a beneficial material in biomedical engineering applications such as skin, bone, and vascular grafts.[5-9] Schneider et al conducted a study regarding use of silk mats incorporated with epidermal growth factor (EGF), for the promotion of wound healing processes and was concluded that there was an increase in wound closure by the epidermal tongue by 90%.[10]

Centella asiatica facilitate the wound healing process in both incision and burn wounds. Amongst a variety of extracts obtained for this plant, ascitic acid in the ethyl acetate extract seemed to be the most active component for healing the wound.[11] It has been reported that 1% C asiatica extract cream improves wound healing of chronic ulcer.[12] It works by inhibiting inflammation, inducing collagen synthesis, promoting angiogenesis inducing vasodilation, reducing wound oxidative stress in addition to promoting cellular growth and proliferation in injured tissues which may be related to growth factors such as endothelial growth factor, fibroblast growth factor and vascular endothelial growth factor.[11]

The third component of the ointiment was silver oxide which has great antimicrobial and bactericidal properties which is due to reaction of the highly charged silver ion (Ag+) to the negatively charged particles such as proteins, DNA, RNA, and chloride ions.[13]

Conclusion

In this study, we have understood to role of biosilk or biomodified silk in enhancement of wound healing and the properties of various properties of biosilk that facilitate the same. To confirm the effectivity of biosilk in healing of wound, it is required to conduct larger randomised control trials.

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