

Abstract

Innovative Biomaterial-Based Therapies Accelerate Wound Regeneration and Modulate Inflammation in Diabetic Mice [†]

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Introduction: Diabetes is a major clinical challenge due to delayed tissue repair, persistent inflammation, and high risk of infection. Innovative strategies that integrate biomaterials, nanotechnology, and phototherapy have shown promise in accelerating healing and improving tissue organization. The local effects of natural latex biomembranes (NLB), enriched or not with curcumin and annatto nanoemulsions (CuraTex) and combined with blue LED phototherapy, on wound healing and tissue regeneration in diabetic mice was evaluated. **Methodology:** Male Balb/c mice with streptozotocin-induced diabetes were subjected to full-thickness wounds infected with *Staphylococcus aureus* and treated for 14 days with saline (negative control), antibacterial ointment (positive control), blue LED, NLB + LED, CuraTex, CuraTex + LED, or nanoemulgel + LED. Treatments were applied every 48 h with 5 min phototherapy sessions. Wound closure was analyzed digitally, and histological assessments evaluated tissue organization and inflammation. All procedures followed ethical guidelines and were approved by the Research Ethics Committee (protocol n° 23106.029983/2024-69). **Results:** Control groups showed incomplete healing and persistent inflammation. Blue LED alone improved contraction, while NLB + LED enhanced stability. CuraTex + LED promoted faster, more homogeneous closure, better histological organization, and greater modulation of inflammation. **Conclusions:** The combination of CuraTex and blue LED phototherapy accelerated regeneration and reduced inflammation in diabetic wounds, demonstrating a smart, biocompatible, and cost-effective approach for chronic wound management.



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Informed Consent Statement: Not applicable. This study did not involve human participants.

Data Availability Statement: The data presented in this study are available on request from the corresponding author. The data are not publicly available due to institutional restrictions.

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