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Exploring the efficacy of antimicrobial photodynamic therapy (aPDT) with magnetic fields (MFs) stimulation in treating methicillin-resistant *Staphylococcus aureus* (MRSA) infected wounds in rats using 532 and 660 nm laser

By

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Abstract	MRSA causes severe wound infections associated with tissue damage and increased apoptosis. This study evaluated the therapeutic efficacy of combining antimicrobial photodynamic therapy (aPDT) with external magnetic field (MF) stimulation in a MRSA infected rat wound model. One hundred male Wistar rats were allocated into five groups for two irradiation wavelengths, 532 nm and 660 nm: control (non-infected and MRSA infected untreated), laser alone, aPDT, laser combined with MF, and aPDT combined with MF. The aPDT protocol involved the topical application of a spinach-derived natural photosensitizer followed by laser irradiation, while a continuous external MF was applied locally over the wound site. Both wavelengths produced progressive reductions in bacterial load, with the magnitude of reduction depending on treatment and day. The aPDT-based treatments produced greater bacterial suppression than laser-only treatments, with aPDT + MF producing the lowest residual bacterial load at both wavelengths. At 532 nm, aPDT + MF produced a significantly lower bacterial load than aPDT alone on Day 4 (estimated mean difference = - 0.36 log₁₀ CFU/mL; adjusted p < 0.001). Histological analysis demonstrated reduced inflammatory cell infiltration and enhanced tissue regeneration in the combined group. These findings indicate that external MF stimulation enhances the antibacterial and tissue repair effects of aPDT in MRSA infected wounds.		
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