

ANTIMICROBIAL PHOTODYNAMIC THERAPY IN THE TREATMENT OF INFECTED POST-AMPUTATION DIABETIC FOOT WOUNDS: A CASE REPORT

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- **INTRODUCTION:** Diabetic foot ulcers represent a major clinical challenge due to their frequently prolonged healing process and increased risk of complications, including osteomyelitis and amputation, resulting in a substantial burden for both patients and healthcare systems. In this context, low-level laser therapy and photobiomodulation (PBM) have been used as adjunctive approaches, with promising results in the modulation of tissue repair and wound healing. Antimicrobial photodynamic therapy (aPDT) may also be used as an adjunctive strategy for local microbial control and wound management, in combination with secondary dressings that maintain a moist and protected wound environment.
- **OBJECTIVE:** To evaluate the clinical evolution and healing process of a post-amputation lower-limb ulcer in a person with diabetes treated with adjunctive antimicrobial photodynamic therapy (aPDT) using low-level laser irradiation combined with a photosensitizer and an antimicrobial secondary dressing, assessing wound response and progression toward complete healing.
- **METHODS:** This case report involved serial clinical follow-up of a person with diabetes presenting with a post-amputation lower-limb ulcer. The initial therapeutic protocol consisted of antimicrobial photodynamic therapy (aPDT) combined with local wound management and an antimicrobial secondary dressing. For aPDT, 1% methylene blue was applied to the wound bed as the photosensitizer, followed by a 5-minute pre-irradiation period to allow photosensitizer uptake. Irradiation was subsequently performed using the Therapy XT® (DMC, Brazil) with red laser light at 660 nm, an output power of 100 mW, and a fluence of 9 J/cm², using a point-by-point technique for 90 seconds per point, totaling 32 irradiation points. A total of 12 aPDT sessions were performed at 72-hour intervals. Kerlix™ AMD antimicrobial hydrophilic cotton gauze (Covidien/Cardinal Health) was used as the secondary dressing. Following completion of the 12 aPDT sessions, treatment was continued with photobiomodulation (PBM) using a multi-emitter light cluster, aiming to support tissue repair through modulation of cellular activity, collagen synthesis, angiogenesis, and inflammatory response. At this stage, the wound showed no clinical signs of infection. Clinical and wound-healing progression was monitored through serial assessments using the Wagner Classification, Visual Analog Scale (VAS) for pain, and Bates-Jensen Wound Assessment Tool (BWAT), together with photographic documentation and evaluation of wound dimensions, wound-bed characteristics, granulation tissue, exudate, and local clinical signs.

- **RESULTS:** During the follow-up period, the wound showed progressive clinical and healing improvement, characterized by a reduction in local clinical signs of infection, improvement in wound-bed conditions, progressive formation of granulation tissue, and reduction in wound dimensions. Systematic assessment using the Bates-Jensen Wound Assessment Tool (BWAT) demonstrated a decrease in score from 40 at baseline to 14 at the end of follow-up, indicating substantial improvement in wound characteristics. After 12 sessions of antimicrobial photodynamic therapy (aPDT), treatment was continued with photobiomodulation (PBM), with sustained favorable progression of the tissue repair process.
- **CONCLUSION:** In this case report, the combination of antimicrobial photodynamic therapy (aPDT) with an antimicrobial dressing, followed by photobiomodulation (PBM), was associated with favorable clinical progression of a complex post-amputation wound in a person with diabetes, with a reduction in local signs of infection and progressive wound healing, as demonstrated by the improvement in the BWAT score from 40 to 14. Notably, wound healing occurred without the need for systemic antibiotic therapy during the healing period, a clinically relevant finding in this case, although it should not be interpreted as supporting the replacement of systemic antibiotics when clinically indicated. This combined approach may represent a promising adjunctive strategy with relative simplicity and clinical applicability for the management of complex and difficult-to-heal wounds. Controlled studies involving larger patient populations are needed to confirm these findings, evaluate their potential impact on systemic antimicrobial use, and support the development and validation of standardized treatment protocols.



Clinical images from the authors' personal archive, reproduced with the patient's written informed consent.

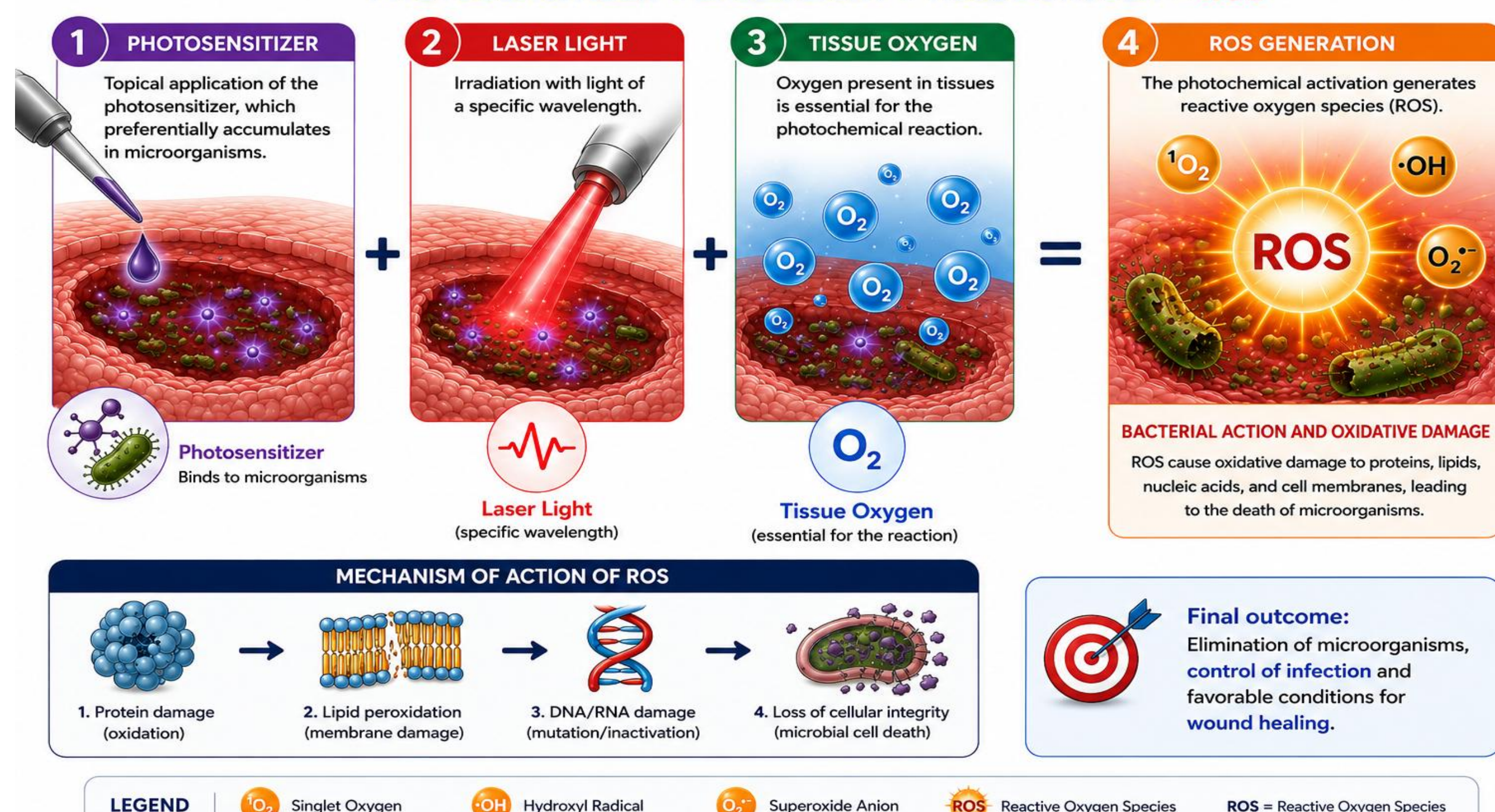
- ① Application of **methylene blue (MB) photosensitizer** to a diabetic foot wound.
- ② Laser irradiation during **antimicrobial photodynamic therapy (aPDT)**.
- ③ Development of granulation tissue with **absence of clinical signs of local infection**.
- ④ Progressive **wound healing process**.

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PRINCIPLE OF PHOTODYNAMIC THERAPY (PDT)

PHOTOSENSITIZER + LASER LIGHT + TISSUE OXYGEN = ROS



Original illustration by the authors, based on the scientific literature on photodynamic therapy and reactive oxygen species

MATERIALS: This case report involved the use of a laser device as part of the therapeutic protocol.