Article type: Perspective

Home Page URL: https,//www.alliedacademies.org/journal-dermatology-research-skin-care/

Photodynamic therapy in dermatology: Treating acne, psoriasis, and skin cancer.

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Received: *03-Sep-2025, Manuscript No. AADRSC-25-167965;* ***Editor assigned:*** *04-Sep-2025, PreQC No. AADRSC-25-167965(PQ);* ***Reviewed:*** *17-Sep-2025, QC No AADRSC-25-167965;* ***Revised:*** *22-Sep-2025, Manuscript No. AADRSC-25-167965(R);* ***Published:*** *27-Sep-2025, DOI:10.35841/aadrsc-9.3.271*

Introduction

Photodynamic therapy (PDT) has emerged as a valuable, minimally invasive treatment in dermatology for a range of conditions including acne, psoriasis, and skin cancer. By combining a photosensitizing agent, a specific light source, and molecular oxygen, PDT induces selective destruction of diseased skin cells while preserving surrounding healthy tissue. With its unique blend of precision, efficacy, and low systemic side effects, PDT is increasingly becoming a mainstream therapeutic choice in dermatological practice. This article explores the mechanisms, applications, and outcomes of photodynamic therapy in treating three major skin conditions.[1].

Photodynamic therapy involves three key components:A light-sensitive compound, such as 5-aminolevulinic acid (ALA) or methyl aminolevulinate (MAL), is applied topically and preferentially absorbed by diseased skin cells. After sufficient incubation, the target area is exposed to a specific wavelength of light—typically in the blue (400–450 nm) or red (630–635 nm) spectrum—chosen based on the absorption profile of the photosensitizer and desired tissue penetration depth. Light activation of the photosensitizer in the presence of oxygen leads to the generation of reactive oxygen species (ROS), which cause oxidative damage, cellular apoptosis, and inflammation at the site of treatment [2].

Light activation of the photosensitizer in the presence of oxygen leads to the generation of reactive oxygen species (ROS), which cause oxidative damage, cellular apoptosis, and inflammation at the site of treatment. Studies show that PDT can significantly reduce both inflammatory and non-inflammatory acne lesions. It is especially beneficial for patients with moderate to severe acne that is resistant to topical or oral antibiotics. Psoriasis is a chronic, immune-mediated skin condition characterized by hyperproliferation of keratinocytes and inflammation, leading to scaly, red plaques.[3].

Upon light activation, ROS-induced damage triggers apoptosis and reduces the local immune response. Although not a first-line treatment, PDT has shown efficacy in localized psoriasis (e.g., nail, scalp, or palmoplantar psoriasis) where conventional therapies are less practical. Improvements are noted in lesion thickness, scaling, and erythema after multiple sessions.Research is ongoing to improve tolerability through optimized light doses and new-generation photosensitizers. including actinic keratoses (AKs), basal cell carcinoma (BCC), and squamous cell carcinoma in situ (Bowen's disease), are prime indications for PDT. [4].

After incubation, red light (deep tissue penetration) is used to activate the photosensitizer, inducing cytotoxic effects in dysplastic or malignant keratinocytes. PDT is highly effective for field cancerization, especially on the face and scalp. It offers excellent cosmetic outcomes with clearance rates of 70–90% after 1–2 treatments. Superficial BCCs respond well to PDT, with clearance rates comparable to surgery in select cases. Nodular types may require adjunct treatments is considered an effective non-invasive option, with good response rates and cosmetic preservation. [5].

Conclusion

Photodynamic therapy represents a powerful and versatile treatment option in modern dermatology. For acne, PDT offers a non-antibiotic approach to reduce bacterial load and sebum production. In psoriasis, it serves as a valuable adjunctive therapy

Citation: Fayek G. Photodynamic therapy in dermatology: Treating acne, psoriasis, and skin cancer. Dermatol Res Skin Care. 2025; 9(3):271

for resistant lesions. Most notably, PDT plays a pivotal role in the non-invasive treatment of early-stage skin cancers and precancerous lesions, offering high efficacy with minimal cosmetic impact.

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Citation: Fayek G. Photodynamic therapy in dermatology: Treating acne, psoriasis, and skin cancer. Dermatol Res Skin Care. 2025; 9(3):271