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study evaluates intra-tissue optical fiber-guided ALA-PDT (OFI-ALA-PDT) to enhance precision and safety.
Approach: Preclinical rabbit ear acne models (n=25) and clinical trials (moderate-severe acne: n=60; nodulocystic acne: n=40; rosacea: n=15) were conducted. OFI-ALA-PDT utilized 3.6% ALA with red light (633±3 nm) delivered via optical fiber needles (3–4 mm depth). Controls received traditional PDT.
Results: Animal models showed faster lesion resolution (Day 14: 100% vs. 60% efficacy, P<0.05) and 70% fewer adverse events (20% vs. 90% erythema, P<0.01). Clinically, OFI-ALA-PDT achieved 90% efficacy in moderate-severe acne after 4 sessions (vs. 66.7% controls, χ^2=4.812, P<0.05) with 63% fewer adverse events (182 vs. 497 events, P<0.01), 95% efficacy in nodulocystic acne (vs. 55% controls, P<0.05), and 86.7% efficacy in rosacea.
Conclusions: OFI-ALA-PDT offers rapid, precise therapy with superior safety, supported by preclinical/clinical data.

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728 oral

Perfluorocarbon nanoemulsion enables inhalable delivery of potent antimicrobial photosensitizer

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Pulmonary antimicrobial photodynamic therapy (aPDT) faces site-specific drug delivery challenges that have hindered its translation into clinical studies.[1] Here, we present a novel nanoemulsion (NE) designed specifically for the treatment of respiratory infections, including a perfluorocarbon (PFC) core, pyropheophorbide (pyro) as a photosensitizer, and lung surfactant-like phospholipids in its composition. Pyro-based NEs have shown incredible preclinical success, with efficacy *in vitro* even in nanomolar concentrations, [2] while PFCs can improve drug delivery through inhalation and carry molecular oxygen.[3] This new pyro-PFC-NE has shown complete inactivation of *S. aureus* in nanomolar concentrations, in conditions that showed little to no toxicity against A549 lung epithelial and EA.hy926 endothelial cells. In addition, its size and photophysical properties are retained after nebulization and when exposed to lung surfactant. These results indicate that pyro-PFC-NE has significant potential for aPDT applications and is compatible with localized delivery to the lungs using nebulization.

Keywords: antimicrobial photodynamic therapy, respiratory delivery, nanotechnology

References

1. Kassab, G. *et al.* Lung surfactant negatively affects the photodynamic inactivation of bacteria—in vitro and molecular dynamic simulation analyses. *Proc. Natl. Acad. Sci.* **119**, e2123564119 (2022).
2. Buzzá, H. H. *et al.* Porphyrin nanoemulsion for antimicrobial photodynamic therapy: effective delivery to inactivate biofilm-related infections. *Proc. Natl. Acad. Sci.* **119**, 1–9 (2022).
3. Lehmler, H. J. Perfluorocarbon compounds as vehicles for pulmonary drug delivery. *Expert Opin. Drug Deliv.* **4**, 247–262 (2007).

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730 oral

Illuminating Stem Cell Fate: Blue Light's Impact on Self-Renewal, Proliferation, Differentiation, and Genomic Stability in Mouse Embryonic Stem Cells

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Significance: Embryonic stem cells (ESCs) are invaluable in regenerative medicine due to their pluripotency and self-renewal capacity. While chemical factors regulating ESCs are well-studied, the impact of physical cues like blue light (BL) remains unclear.
Approach: We investigated the effects of BL (411–415 nm) on ESC growth, self-renewal, genetic stability, and differentiation.
Results: Low doses of BL (3.3 and 10 J/cm^2) stimulated ESC proliferation without impairing self-renewal or increasing DNA damage, monitored via xCELLigence and homologous recombination assays. During differentiation into epidermal cells, BL exposure on day 0 or day 2 affected embryoid body integrity and altered the expression of pluripotency and epidermal markers (Oct4, Nanog, Krt8, Krt14).
Conclusions: These findings suggest that BL can promote ESC proliferation while modulating differentiation outcomes, providing a potential tool for optimizing ESC culture in regenerative applications.

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731 Poster Highlight Presentation

Selection and Validation of Reference Genes for qPCR Analysis Under 409 nm and 415 nm Antimicrobial Blue Light Exposure

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Significance: Antimicrobial blue light (aBL) is a promising alternative to combat multidrug-resistant bacteria. Stable reference genes are essential for accurate gene expression analysis under stress conditions such as aBL exposure. This study addresses the lack of information on appropriate reference genes for aBL-treated Escherichia coli.
Approach: Candidate genes were analyzed for stability under 409 and 415 nm aBL using BestKeeper, geNorm, NormFinder, and RefFinder algorithms.
Results: The gene encoding the integration host factor β subunit (ihfB) was identified as the most stable reference gene, followed by cysG, uidA, and gyrA. Minimal differences in gene expression were observed between wavelengths, with a significant increase in oxyR (oxidative stress regulator) at 409 nm.
Conclusions: ihfB is recommended for reliable normalization in aBL gene expression studies, enhancing the accuracy of transcriptomic analyses in this emerging antimicrobial strategy.

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733 oral

Porphyrin Modifications for Enhanced Photodynamic Inactivation of Microbial Pathogens

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Significance: Diseases caused by bacteria affecting the upper respiratory tract are a concern in the healthcare system, according to the World

Health Organization. Multidrug-resistant Klebsiella pneumoniae is considered a critical pathogen due to its antibiotic resistance.
Approach: Photodynamic therapy (PDT) is a promising alternative, using photosensitizers (PSs) and light to generate reactive oxygen species for bacterial inactivation. This study evaluated porphyrin derivatives with different substituents against K. pneumoniae. The bacteria were incubated for 1h with different meso-substituted porphyrins (cationic, neutral, and negatively charged) in a range of concentrations. Samples were irradiated in the therapeutic window at different light doses. Treatments were evaluated by viability assay.
Results: Cationic imidazolyl-derived porphyrins achieved >3 log bacterial reductions under irradiation, and effectiveness depended on PS concentration and light dose.
Conclusions: Designed porphyrins show promise for K. pneumoniae PDT, supporting PDT as a non-antibiotic strategy against resistant infections. Understanding substituent effects aids the design of next-generation antimicrobial photosensitizers.

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734 oral

Transcriptomic responses of Escherichia coli to antimicrobial photodynamic therapy

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Significance: Antimicrobial resistance is a major global threat but aPDT is a promising alternative to combat multidrug resistance bacteria. Unfortunately, a lack of knowledge on the response of bacteria to this treatment can be an obstacle to use aPDT as a routine therapy.
Approach: This study investigated transcriptomic changes in Escherichia coli following photodynamic treatment utilizing RNA-seq approach, followed by Gene Ontology (GO) and KEGG pathway analysis. Key up-regulated genes were further validated using single-gene mutants from the KEIO collection.
Results: aPDT induced significant transcriptional changes, affecting 1496 genes (829 up-regulated, 667 down-regulated). The ten most up-regulated genes were associated with stress response, membrane damage, and oxidative stress protection. KEGG analysis highlighted pathways related to ABC transporters and microbial metabolism.
Conclusions: Antimicrobial photodynamic therapy triggers differential expression of numerous genes with an emphasis on those involved in defense and adaptation.

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736 Poster

Quality of Life in Port-Wine Stains of Children and Their Parents

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Port-wine stain (PWS) is a congenital capillary malformation that does not resolve spontaneously, causing physical and psychological burdens to patients. In this study, we used the Pediatric Dermatologic Quality of Life Index Questionnaire, PedsQL, and the Family Dermatologic Quality of Life Index Questionnaire to evaluate the impact of PWS on the quality of life of children and their parents. TThe results revealed a significant positive correlation between the quality of life of both children with PWS and their parents.

An increasing number of PWS photodynamic treatments negatively affected the quality of life of affected children. Patient age was positively associated with parental quality of life, and it had a greater effect on mothers' vs fathers' quality of life. In conclusion, the impact of PWS on the quality of life of patients and their parents was clinically significant and significantly affected by treatment.

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737 oral

Good response to DSA and PDT in patients with capillary malformation-arteriovenous malformation syndrome (CM-AVM).

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Capillary malformation-arteriovenous malformation (CM-AVM) syndrome is an autosomal dominant genetic disorder caused by heterozygous mutations in the RASA1 and EPHB4 genes. The capillary spots in CM-AVM are consistent with stage I arteriovenous malformations as defined by the Schobinger classification. Traditionally, laser treatment of arteriovenous malformations has been contraindicated due to concerns about accelerating their progression. In this study, we treated capillary spots in five patients with CM-AVM with interventional drug infusion under DSA followed by PDT photodynamic therapy. During one year of clinical and ultrasound follow-up, the lesions improved without any deterioration or recurrence.

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746 oral

Electrocoagulation Combined with Photodynamic Therapy for Moderately to Well-Differentiated Cutaneous Squamous Cell Carcinoma: A Case Series of 10 Elderly Patients

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Significance: Traditional surgical approaches and single minimally invasive therapies suffer from limitations such as high invasiveness or insufficient efficacy, failing to meet the treatment needs of elderly patients with cutaneous squamous cell carcinoma (cSCC). To address this challenge, we developed an innovative minimally invasive strategy combining electrocoagulation and photodynamic therapy (PDT).
Methods: Tumor tissues were removed via high-frequency electrocoagulation in 10 elderly patients with moderately to well-differentiated cSCC, followed by aminolevulinic acid-based PDT administered at least three times. Post-treatment follow-up focused on local aesthetic recovery, functional preservation, and tumor recurrence.
Results: After combined therapy, all patients achieved complete tumor clearance with preserved local appearance and function. No recurrence was observed during a follow-up period exceeding six months.
Conclusion: The combination of electrocoagulation and PDT proves effective, minimally invasive, and convenient for treating moderately to well-differentiated cSCC, particularly in elderly patients. This dual approach warrants broader clinical adoption.

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