SEVC SOUTHERN EUROPEAN VETERINARY CONFERENCE
SEVILLE, 23-25 October 2025

FLUORESCENT LIGHT THERAPY IN DERMATOLOGY: HOW IT WORKS AND WHY WE USE IT

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INTRODUCTION

Antibiotic-resistant bacterial and antifungal-resistant fungal infections are on the rise in veterinary medicine.[1] Improper use of antimicrobials has propagated the rapid spread of antimicrobial resistance across many species of organisms, including bacteria. More concerning, these bacteria can spread resistance genes within a given host species, or across host species. This means that antimicrobial resistance within veterinary species is impacting antimicrobial resistance in human species, and vice versa. With the emergence of hospital-acquired and community-acquired methicillin-resistant bacterial infections in both dogs and humans the need for proper antimicrobial usage becomes even more important. Additionally, the use of animals in the medical field as "therapy animals" is becoming more widespread, and this may pose even greater risks for spread of resistant infections and/or genomes between humans and dogs. It is for these reasons that it is imperative that each antimicrobial agent is used properly within a given population to avoid antimicrobial resistance, and that alternatives to antibiotics should be considered first whenever possible.[2] Recently, a new antibiotic-free treatment modality for superficial and deep pyoderma in dogs and cats is available for use in veterinary medicine called fluorescence photobiomodulation (PBM) therapy.

HOW PHOTOBIOMODULATION WORKS

PBM, or low-energy light therapy, is a type of treatment that uses light to alter cellular metabolic pathways to induce therapeutic benefits including promotion of tissue healing and regeneration, and inhibition of biological responses that induce pain or inflammation. Early light applications employed laser light emitters commonly described as "cold laser" or "low-level laser therapy".[3] These laser devices, however, have demonstrated limited efficacy in veterinary dermatology, with recent studies of atopic dermatitis patients, post-surgical wound healing models, and open wound healing models showing no advantageous in treated dogs versus control.[4-6]

Specific benefits of light energy within the visible light spectrum are specific to the wavelength of light, which determines the color of light, and includes reducing bacterial adhesion to keratinocytes, reducing tissue swelling and inflammation, promoting collagen synthesis, and promoting tissue repair.[7-9]

PBM uses the interaction of visible (400 - 750 nm) to near-infrared light waves with endogenous cellular chromophores such as water, melanin, porphyrin, flavins, and cytochrome C oxidase to create a desired effect (e.g. reduction of inflammatory mediators, activation of fibroblasts and keratinocytes, decreased bacterial adhesion to keratinocytes, bacterial killing, etc.).[8] The wavelength, intensity, and duration of illumination influence the effects of light on skin tissue.[7,9]

Blue light (400 - 495 nm) has the shallowest penetration into skin, reaching the epidermis and superficial dermis. Blue light primarily has been studied for its antimicrobial effect. The antimicrobial effect is thought to be due to blue light triggering the production of reactive oxygen species within the bacterial cells resulting in cell death. Blue light phototherapy has been shown to alter the structure of methicillin-resistant *Staphylococcus aureus* (MRSA), which disrupts the cell membrane and decreases its ability to replicate. Human studies have found efficacy against fungal species such as *Candida* sp., *Malassezia* sp., and dermatophytes. Green light (495–570 nm) can penetrate into the mid-dermis. It has been studied for its effects on wound healing, osteoblast differentiation, alteration of melanogenesis, and regulation of intracellular calcium. Yellow and orange light (570-600 nm) can stimulate collagen synthesis, improve wound healing, and reduce skin pathogens. Red light (600 - 750 nm) can reach the deep dermis or hypodermis depending on the thickness of the skin. This set of wavelengths has been studied for its effects

on wound healing and demonstrated to reduce inflammation, increase collagen synthesis, and induce proliferation of mesenchymal stem cells and epithelial cells. The primary proposed mechanism of the effects of red light on wound healing is the stimulation of adenosine triphosphate within the mitochondria.

HOW FLUORESCENCE PHOTOBIOMODULATION WORKS

Fluorescence PBM is a form of PBM in which the light emitted from the initial light source is altered by an exogenous chromophore. This creates longer wavelength photons and expands the therapeutic potential. The commercially available form of fluorescence PBM is called the Phovia® System made by Vetoquinol. This system uses a topical photoconverting hydrogel and a blue light emitting diode (LED) lamp (400-500 nm). The interaction of the light from the LED lamp and photoconverting hydrogel emits low-energy fluorescence within the 500 - 700 nm range.[8] This interaction results in the formation of multiple wavelengths of visible light each with a unique depth of penetration and effect on the tissue. Fluorescence PBM has been studied in several dermatological conditions in dogs including superficial pyoderma, deep pyoderma, interdigital pyoderma, perianal sinuses, otitis externa, acute traumatic wounds, chronic wounds, and surgical wounds. It is also being studied for the treatment of dermatological diseases in other species including birds, small mammals, horses, and cats.

The primary proposed mechanism of fluorescence PBM in wound healing is the stimulation of adenosine triphosphate within the mitochondria. The blue-green wavelengths may also help regulate intracellular calcium. In a study on canine deep pyoderma, areas treated with fluorescence PBM showed less tissue inflammation when compared to systemic antibiotics alone.[10] Similar findings were demonstrated in studies evaluating canine surgical wounds.[11-13] In two studies, this was evidenced on a molecular level with a decrease in the pro-inflammatory marker tumor necrosis factor-$\propto$ and an increase in the anti-inflammatory markers such as epidermal growth factor and collagen III.[11-12]

HOW TO USE IT

The use of Phovia® System is typically well tolerated by patients. In most cases, it can be performed without the need for sedation. However, in cases where the patient is painful or does not allow contact with the affected area, sedation may be required. The photoconverting hydrogel comes in two parts: a jar of clear hydrogel and an ampule of orange photoconverter liquid. These two parts are combined prior to application. Once combined the photoconverting hydrogel is only stable 7 days at refrigeration and should be kept in a dark area.

The Phovia® System package includes the LED lamp, photoconverter hydrogel, fluorescence gel, tongue depressors, charging stand and chord, and protective eye wear. If any cellular debris or crusting is present on the lesion, the area should be gently cleaned prior to treatment to avoid any impedance of the light to reach the skin. The photoconverter gel is mixed with the fluorescence chromophore gel and applied in a two mm layer to the affected skin. The lamp is placed just above the gel and illuminated at a five cm distance above the lesion for two minutes. Following the two minutes, the LED lamp will automatically turn off. The hydrogel should be removed from the skin using gauze soaked in sterile saline. As blue light is emitted by the LED lamp, the users should wear appropriate blue-light filtering protective goggles and the patient's head should be facing away or their eyes covered while illumination occurs. The veterinary care team is required to wear specific eyewear to protect them from the intensity of the LED light; however, the LED lamp is not a Class III-IV medical laser and is not damaging to the retina.The manufacturer recommends that the treatment be performed twice per week. This can either occur as a single treatment once every 3 to 4 days. Alternatively, the treatments can be performed consecutively with a one-minute resting period. When using consecutive treatments, the hydrogel should be removed and reapplied between illuminations. The treatment has a favorable safety profile; however, topical reactions occur rarely. Application is pain-free and stress-free for the patient, so sedation is not typically required.

Appropriate case selection is paramount in treatment success. Phovia® shows great promise as a safe and effective therapy for the treatment of numerous inflammatory dermatoses in dogs including superficial pyoderma,[14-15] antibiotic-resistant pyoderma,[16] deep pyoderma,[10] perianal fistula,[17] interdigital dermatitis,[18] calcinosis cutis,[19] acute traumatic wounds,[20] chronic wounds,[21] surgical wounds,[12-13] and otitis externa.[22] Phovia® as a sole therapy even speeds the time to healing by 36% in canine superficial pyoderma as compared to dogs receiving oral antibiotics alone.[14] In one study, dogs with superficial pyoderma were

treated with Phovia® alone or with an oral antibiotic alone. Dogs treated twice weekly with Phovia® demonstrated complete clinical healing in 2.3±0.7 ($p<0.05$) whereas dogs receiving oral antibiotic healed in 3.75±1 weeks.[14] Additionally, Phovia® speeds time to healing by nearly 50% in deep pyoderma when used with an oral antibiotic (5.7 weeks of treatment) compared to dogs receiving only oral antibiotic (11.7 weeks of treatment).[10] The ability of this fluorescence PBM therapy to eliminate or significantly reduce duration of exposure to antibiotics will decrease the spread of antibiotic-resistant bacterial strains within pets and people. If the disease process is beyond skin depth, then this treatment modality is not recommended since penetration of the light is limited to the skin structures.

CONCLUSION

Studies over the last 50 years demonstrate PBM as an effective and safe treatment for dermatological conditions. The ability of fluorescence PBM to eliminate or significantly reduce duration of exposure to antibiotics in veterinary species will decrease the spread of antibiotic-resistant bacterial strains within pets and people. Veterinarians continue to play an important role in the One Health initiative, and application of Phovia® in everyday cases will contribute to this standard of care.

REFERENCES

1. Palma, E., Tilocca, B. & Roncada, P. Antimicrobial Resistance in Veterinary Medicine: An Overview. Int. J. Mol. Sci.21, (2020).
2. Hillier, A. et al. Guidelines for the diagnosis and antimicrobial therapy of canine superficial bacterial folliculitis (Antimicrobial Guidelines Working Group of the International Society for Companion Animal Infectious Diseases). Veterinary Dermatology vol. 25 163–e43 Preprint at https://doi.org/10.1111/vde.12118 (2014).
3. Hochman L. Photobiomodulation Therapy in Veterinary Medicine: A Review. Topics in Companion Animal Medicine 2018;33(3):83-88. doi:10.1053/j.tcam.2018.06.004
4. Stich AN, Rosenkrantz WS, Griffin CE. Clinical efficacy of low-level laser therapy on localized canine atopic dermatitis severity score and localized pruritic visual analog score in pedal pruritus due to canine atopic dermatitis. Vet Dermatol. 2014;25(5):464-e74. doi:10.1111/vde.12144.
5. Kurach LM, Stanley BJ, Gazzola KM, Fritz MC, Steficek BA, Hauptman JG, Seymour KJ. The Effect of Low-Level Laser Therapy on the Healing of Open Wounds in Dogs. Vet Surg. 2015;44(8):988-996. doi:10.1111/vsu.12407.
6. Gammel JE, Biskup JJ, Drum MG, Newkirk K, Lux CN. Effects of low-level laser therapy on the healing of surgically closed incisions and surgically created open wounds in dogs. Vet Surg. 2018;47(4):499-506. doi:10.1111/vsu.12795
7. Cios, A. et al. Effect of Different Wavelengths of Laser Irradiation on the Skin Cells. Int. J. Mol. Sci.22, (2021).
8. Marchegiani A, Spaterna A, Cerquetella M. Current Applications and Future Perspectives of Fluorescence Light Energy Biomodulation in Veterinary Medicine. *Veterinary Sciences* 2021;8.
9. Avci, P. et al. Low-level laser (light) therapy (LLLT) in skin: stimulating, healing, restoring. Semin. Cutan. Med. Surg.32, 41–52 (2013).
10. Marchegiani A, Fruganti A, Spaterna A, et al. The Effectiveness of Fluorescent Light Energy as Adjunct Therapy in Canine Deep Pyoderma: A Randomized Clinical Trial. Veterinary Medicine International 2021;2021.
11. Scapagnini G, Marchegiani A, Rossi G, et al. Management of all three phases of wound healing through the induction of fluorescence biomodulation using fluorescence light energy, in Proceedings of SPIE. Conference on Photonic Diagnosis and Treatment of Infections and Inflammatory Diseases II 2019.
12. Salvaggio A, Magi GE, Rossi G, et al. Effect of the topical Klox fluorescence biomodulation system on the healing of canine surgical wounds. Vet Surg 2020;49:719-727.
13. Marchegiani, A., Troisi, A., Bazzano, M., Spaterna, A. & Fruganti, A. A prospective, blinded, open-label clinical trial to assess the ability of fluorescent light energy to enhance wound healing after mastectomy in female dogs. Animals (Basel)14, (2024).
14. Marchegiani A, Fruganti A, Cerquetella M, et al. Klox fluorescence biomodulation system (KFBS), an alternative approach for the treatment of superficial pyoderma in dogs: preliminary results. BSAVA Conference Proceedings 2018 2018:442.
15. Marchegiani, A., Spaterna, A., Fruganti, A. & Cerquetella, M. Exploring fluorescent light energy

as management option for canine superficial bacterial folliculitis. Front Vet Sci10, 1155105 (2023).
16. Marchegiani, A. et al. Fluorescent Light Energy in the Management of Multi Drug Resistant Canine Pyoderma: A Prospective Exploratory Study. Pathogens11, (2022).
17. Marchegiani A, Tambella AM, Fruganti A, et al. Management of Canine perianal fistula with fluorescence light energy: preliminary findings. Vet Dermatol 2020;31:460-+.
18. Marchegiani A, Spaterna A, Cerquetella M, et al. Fluorescence biomodulation in the management of canine interdigital pyoderma cases: a prospective, single-blinded, randomized and controlled clinical study. Vet Dermatol 2019;30:371-+.
19. Apostolopoulos N, Mayer U. Use of fluorescent light energy for the management of bacterial skin infection associated with canine calcinosis cutis lesions. Vet Record Case Reports 2020;8.
20. Marchegiani A, Spaterna A, Piccionello AP, et al. Fluorescence biomodulation in the management of acute traumatic wounds in two aged dogs. Veterinarni Medicina 2020;65:215-220.
21. Hoisang, S., Kampa, N., Seesupa, S. & Jitpean, S. Assessment of wound area reduction on chronic wounds in dogs with photobiomodulation therapy: A randomized controlled clinical trial. Vet World14, 2251–2259 (2021).
22. Tambella AM, Attili AR, Beribe F, et al. Management of otitis externa with an led-illuminated gel: a randomized controlled clinical trial in dogs. BMC Veterinary Research 2020;16.