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OneHealth Applications of Low Level Laser Therapy

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Abstract

Advances in human medicine have long been founded on the initial research conducted with animals. New products and innovative treatment options that are successful in pre-clinical rodent, canine and/or nonhuman primate studies, will then typically focus on the initiation of human clinical trials.

The potential for successful introduction into the human health market often overshadows and ignores the possible animal health benefits of the product--even in cases where the safety and efficacy results in research models are exceptional.

Despite this tendency, the OneHealth movement has facilitated an unprecedented paradigm shift as innovative human medical discoveries are introduced for animal health applications. Essentially, products proven effective and safe in people are viewed as having comparable benefits when used for cats and dogs.

An example of OneHealth translational technology is discussed in this review and centers on the benefits of employing a Low Level Laser Therapy device (LLLT) at home for a variety of indications that have similar etiologies and treatment options for both animals and people, including the treatment of arthritis, joint injuries, chronic dermatological conditions, and dental problems.

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Keywords

Canine Laser; Feline Laser; One Health; At Home Laser Treatment; LLLT; Veterinary Clinical Trials; Veterinary Laser

Introduction

Advances in human medicine have long been founded on the initial research conducted with animals [1]. New products and innovative treatment options must successfully transit a regulated pathway including studies in rodents, canines and/or nonhuman primates before approval for marketing and use in treating animals or people is granted [2].

Upon achieving favorable preclinical results for a novel drug, device or treatment option, sponsors (and their investors) will typically focus on the initiation of human clinical trial phases.

Unfortunately, once the prospect of successful sales into the human market is realized even in cases where the safety and efficacy results in research models are exceptional the potential animal health benefits for same-species access to the investigational product can be easily overlooked. This is, perhaps, best understood when the sizes of the two markets are compared, i.e., the human global healthcare market was valued at $ 8.5 Trillion in 2018, whereas the global animal health industry was pegged at $ 33 Billion in 2019 [3,4].

The consistent expansion of the worldwide life science arena has generated concomitant growth in the R and D segment that supports it, delivering a steady stream of innovation into the marketplace [5]. Despite the challenges, an unprecedented paradigm shift has come about as a number of innovative human medical discoveries continue are introduced for animal health applications. Essentially, products proven effective and safe in people are viewed as likely having comparable benefits when used for cats and dogs.

The translational technology discussed in this review centers on the benefits of employing a Low Level Laser Therapy device (LLLT) at home for a variety of indications that have similar etiologies and treatment options for both animals and people. B-Cure Laser is currently supporting several clinical trials that are exploring the indications for which LLLT will most closely mirror the significant benefits in animal patients as they do in people, including the treatment of arthritis, joint injuries, chronic dermatological conditions, and dental problems [6].

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Background- A Historical Perspective

Einstein published his laser theory (Light Amplification by Stimulated Emission of Radiation) in 1913, but it took 50 years for the technology to make any significant progress in medicine [7]. The 1963 experimental ablation of atherosclerotic plaques set the stage for the 1983 advent of an era of broad reaching clinical applications in both human and animal medicine and surgery.

Just as the industrial applications of lasers (barcode scanning, broadband fiber-optics, machining of semiconductors for electronics) are an everyday part of our lives, the benefits of the scientific uses of light technology have achieved broad acceptance within the medical and dental communities especially in the last decade [8-10]. Photomedicine is an actively growing field with over 5,700 PubMed citations and an increasing number of high impact factor journals publishing LLLT related studies.

Among the many surgical applications of lasers are [11]:

- Cosmetics and plastic surgery- the removal of scar tissue
- Dentistry- endodontic and periodontic procedures, oral surgery
- General surgery- tumor and cataract removal, many routine procedures
- Ophthalmic (LASIK) surgery- for vision correction and/or improvement

The surgical benefits of laser therapy are supplemented by a comprehensive catalog of non-surgical medical applications, some of which are:

- Amelioration of chronic and peri-operative pain
- Osteoarthritis and acute sports injuries
- Reduction of inflammation
- Acceleration of wound healing and ulcer repair
- Promotion of cell growth and improved vascularization
- Reduction of scar tissue formation
- Improved nerve function
- Dermatology
- Dentistry

Mode of Action

Light from an ordinary bulb has many wavelengths and radiates in all directions. Laser light utilizes a specific wavelength concentrated in a narrow beam. When this high-intensity laser

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light is precisely focused on a small area, it can cut tissue and can be employed like a scalpel for use in treating specific tissues.

A laser's wavelength is the primary determinant of the depth of energy penetration. Different wavelengths are absorbed by the dissimilar chromophores part of a molecule responsible for color- containing water, skin pigment, and hemoglobin that affect laser depth of penetration. The energy of surgical lasers is absorbed by water at the skin level to eliminate the possible passage of energy below the incision or target site. In laser therapy, penetrating below the skin allows the healing energy of the laser to reduce pain and inflammation in muscles, bones, joints, tendons, and nerves.

LLLT (also known as Cold Laser, Photobiomodulation, and Laser Biostimulation) is a non-invasive low intensity light therapy that produces a biochemical alteration in cells. The process is comparable to photosynthesis whereby photons absorbed by plant cellular photoreceptors are converted to chemical energy which is then available to fuel plant activity [12]. The lasers Photobiomodulatory (PBM) effects modulates cellular activity and enhance the processes that contribute to tissue repair. By inducing cellular proliferation and enhancing stem cell differentiation, inflammation is reduced, pain modulated, and by augmenting the healing process and tissue repair, a patient's quality of life is improved.

The biochemical processes involved in PBM amplify a cellular level cascade and, through tissue effects, ultimately contribute to the many well-documented systemic benefits, including reduced pain and accelerated healing processes that offer a pathway to faster medical outcomes and improved quality of life for patients. The biostimulatory healing effects of LLLT in the treatment of chronic pain, OA, acute and chronic soft tissue injury, and wound healing, are as significant for animals as they are in human healthcare.

Equipment

Much-of the uncertainty surrounding the efficacy of LLLT is due to the wide range of devices currently in use, variability of energy delivery, as well as the inconsistencies of administration in the field by physicians, dermatologists, and veterinarians [13].

The compelling need for comprehensive research to study and validate LLLT function in a variety of therapeutic interventions in animals [(M)] is being addressed by Veterinary Health Research Centers. Multi-site studies are underway in dogs and cats utilizing the same B-Cure Laser equipment as used in the human trials. The device delivers a constant dosage of 808 nm (Fig. 1) over a defined area, the only variable being the length of treatment time [14].

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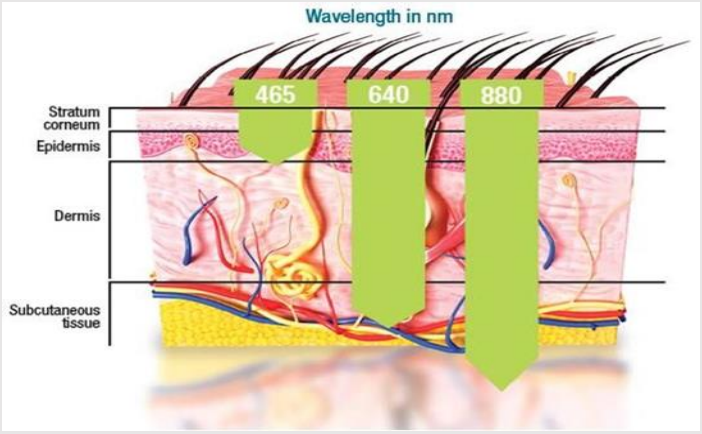

Figure 1: B-Cure Operating wavelength = 808 nm (Courtesy GOOD ENERGIES USA INC.).

Photomedicine and Laser Surgery published a systematic literature review supporting the efficacy of B-Cure Lasers compared to other medical photomedicine devices designed for the treatment of pain and wound healing in an at-home setting.

A 2020 review of the available PubMed and Google Scholar literature examined LLLT that was used for the non-surgical treatment of skin, cancer, and orthopedic diseases.

The B-Cure Laser was cited in 4 of the 14 clinical trials investigating wound treatment and pain with LLLT. Twenty-nine percent of the study patients in the review literature received treatment using the B-Cure Laser device (Fig. 2).

Figure 2: B-Cure laser vet device (Courtesy GOOD ENERGIES USA INC.).

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Current Studies

Dental Disease

Dental disease is a major problem in cats and can cause serious pain, discomfort, and negatively impact quality of life [15]. Similarly, periodontal disease is the most common infectious disease of adult dogs. Dental disease affects over 87% of dogs and 70% of cats over three years of age [16].

LLLT has a played a significant role in reducing the discomfort and pain associated with temporomandibular joint disease, and pre-and postoperative dental surgeries [17-21].

Clinical trials hosted by veterinary practices using B-Cure Lasers for the at-home treatment of canine and feline gingivitis (Fig. 3) are underway. Results will be published as soon as available.

Figure 3: Positioning for LLLT treatment of feline gingivitis. Creative commons https://upload.wikimedia.org/wikipedia/commons/thumb/3/34/Light_Penetration.png/330px-Light_Penetration.png

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Cruciate Pain and Orthopedic Surgery

In a review of the over 4000 LLLT laboratory and clinical studies on pub.med.gov, Colter, et al., reported that the majority have validated the therapy as having a positive effect on both acute and chronic musculoskeletal pain [22].

When LLLT was used in cases of spinal surgery in people, decreases in post-operative temperature and drainage were described, pain relief and accelerated healing in people receiving laser therapy were reported [23].

The recipients of LLLT treatments recounted decreased post-operative orthopedic pain, suggesting the use of LLLT could improve quality of life and return to function following canine orthopedic procedures [24]. There is also the potential to reduce the use of NSAIDs, which can be problematic, especially in older animals.

Chronic Wounds

In a diabetic ulcer clinical trial, it was reported that 12 weeks of daily LLLT treatments using the B-Cure Laser, significantly decreased wound size in patients with diabetic foot ulcers [25]. Notably, in these often difficult to treat wounds, 70% of the active patients vs. 11% of the sham patients had 90% wound closure by the end of the study.

Canine patients presented with lick granulomas (also called acral lick granuloma, acral lick dermatitis, acral pruritic nodule and ALD) exhibit localized self-trauma caused by continual licking, most commonly at the lower leg. The chronic irritation results in hard-to-heal open sores.

Perianal fistulas are tracts that develop in the skin and tissues surrounding the anal area of dogs, most commonly in German shepherds. The lesions may first appear as small excoriations which if untreated, can progressively grow wider and tunnel deeper into the surrounding tissue. Perianal fistulas cause severe irritation, pain and discomfort and, if not controlled, may be responsible for a dramatic reduction in quality of life. Affected dogs often exhibit concurrent chronic diarrhea due to inflammatory bowel disease, showing many similarities to Crohn's disease in people.

Clinical trials hosted by veterinary practices using B-Cure Lasers for the at-home treatment of lick granulomas and perianal fistulas are underway. The studies are exploring the ability of LLLT to reduce pain, inflammation, and localized edema, and to promote wound and deep tissue healing for these chronic conditions. Results will be published as soon as available.

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Pain

The pain associated with osteoarthritis in both people and animals can have a detrimental effect on the patient's well-being and may delay or even prevent the patients from completing treatment regimens [26]. Supporting orthopedic patients with a PBM device for at-home treatment of a variety of joint inflammation and painful musculoskeletal conditions (Fig. 4) makes LLLT an important modality for continuing care and for fostering patient compliance.

Additionally, many of the logistic challenges presented by the COVID pandemic can be mitigated or avoided when patients are not required to visit a treatment facility for laser treatments.

Clinical trials hosted by veterinary practices using B-Cure Lasers for the at-home treatment of joint, hip, and spine pain and osteoarthritis are underway. The studies are exploring the ability of LLLT to reduce inflammation and associated pain and to promote healing of both acute chronic conditions. Results will be published as soon as available [27].

Figure 4: Treating shoulder strain.

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Conclusion

The utilization of LLLT lasers in companion animals offers an opportunity for veterinary practitioners to gain from the long-term utilization and positive experience of physicians, dentists, and physical therapists with LLLT as a safe treatment modality in human health care.

Both in the clinic and at home, achieving positive therapeutic outcomes with LLLT requires repeated short treatment sessions, especially when dealing with chronic or recurring conditions. The safety profile, ease-of-use and convenience of a lightweight hand-held device makes LLLT a compelling option for achieving and maintaining optimal patient health and quality of life without the use of pharmaceuticals.

Conflict of Interest

The author declares that Veterinary Health Research Centers is currently conducting multi-site clinical trials to further validate additional Vet Low Level Laser Therapy applications of the BCure Laser Vet in treating pain and inflammation associated with canine and feline diseases. Results will be reported here.

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