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Contents

Use of the MLS® Laser Therapy in the management of SARS-CoV-2 infection: a case report

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INTRODUCTION

COVID-19 (Coronavirus Disease 2019) is a viral disease caused by the infection of an RNA virus, SARS-CoV-2 (Severe Acute Respiratory Syndrome CoronaVirus 2). Since the first cases in Wuhan at the end of 2019, SARS-CoV-2 has spread rapidly to many countries around the world causing a global health emergency. Indeed, its high speed of propagation and the various forms of contamination led the World Health Organization to declare a pandemic on March 11th, 2020 [1]. Most COVID-19 patients are asymptomatic or show mild symptoms, such as cough, fever, anosmia and ageusia: in these instances, patients usually do not need hospitalization [2]. However, the outcome of COVID-19 is often unpredictable, especially in elderly patients or patients who present comorbidities (obesity [3] or diabetes [4], for example).

Typically, the longer the symptoms persist, the greater the risk of developing a more severe form of COVID-19, which could lead to hospitalization, invasive mechanical ventilation and, consequently, admission to intensive care units. Common complications include cardiovascular events, acute respiratory distress syndrome (ARDS) and a condition of excessive inflammation referred to as a "cytokine storm" [5,6,7]. Since 2019, the SARS-CoV-2 infection and its consequences has led to the death of more than 3,9 million of people, to hospital overcrowding, to increased costs for national health systems and to a critical condition not only in the medical environment, but also in the social, economic, and cultural fields.

Since SARS-CoV-2 activates alveolar macrophages and neutrophils causing inflammation and vascular permeability, one of the most problematic effects of COVID-19 infection is the excessive production of pro-inflammatory cytokines, which can damage the lung structure and can also spread to other organs, damaging them [8]. Therefore, it seems crucial to find a targeted therapy able to modulate the immune system and control inflammation. Currently, the most common protocols for treating COVID-19 involve different types of drugs and different strategies (Hydroxychloroquine, antivirals such as Remdesivir, or immunomodulatory therapies with interferon, e.g.). Numerous clinical trials are underway, but so far, no therapy has been shown to be targeted and fully effective against the symptoms caused by the virus infection [9].

An emerging strategy that could help modulating the inflammatory response in COVID-19 patients is photobiomodulation therapy (PBMT). It is an adjunctive therapy already used in various fields, such as wound healing [10], musculoskeletal pain [11], asthma [12], etc... where it has already proven to exert a significant anti-inflammatory action. PBMT involves the use of non-ionizing, non-thermal light sources in the visible and infrared spectra (400-1000 nm) that are absorbed by intracellular chromophores and promote a cascade of intracellular reactions promoting the healing process in the tissue [13]. There

are various recent studies and systematic reviews that show the beneficial effect of PBMT in the treatment of COVID-19 patients [14,15,16]. Moreover, PBMT is a non-pharmacological, non-invasive and inexpensive therapy and has not shown adverse side effects. This case report describes the application of a Multiwave Locked System (MLS®) laser in the management of a COVID-19 patient.

CASE DESCRIPTION

The patient is a 70-year-old man who was admitted to the hospital (standard department) on Feb. 7th 2021 with symptoms of respiratory failure, cough, gagging and chest pain, and radiographic evidence of atypical COVID-19 pneumonia (presence of bilateral multifocal consolidations; presence of interstitial infiltrates – associated or not with alveolar infiltrates – with predominantly bilateral and basal distribution; ground glass opacities in the periphery of both lungs in the mid and lower zones). At his arrival, the oxygen saturation level (SpO2) was 90% (free air). Ferritin level was 1500 ng/ml. On Feb. 9th 2021 the oxygen saturation level was 95% (2l O2/ min); on the same day, the patient started laser therapy. During the hospitalization the patient received the following pharmacological therapy:

Antibiotics: cephalosporin (Sefotak) 1g, intravenously, three times a day
Corticoids: Dexamethasone 8 mg, intravenously, once a day
Anticoagulants: Heparin (Fraxiparine) 0,6 ml, subcutaneously, twice a day
Antitussives: Codein, 30 mg, orally, once a day Probiotics: Linex forte, 25 mg, orally, once a day
Mucolytics: Ambrobene, 30 mg, orally, twice a day Aldosterone antagonists: Verospiron, 25mg, orally, once a day, as needed Infusion (Plasmalyte) 1000 ml, intravenously, once a day, as needed A Multiwave Locked System laser (MLS®-M6, ASA S.r.l., Vicenza, Italy) was used to perform the PBMT.

It is a class IV NIR laser with two synchronized sources: the first one consists in three GaAlAs laser diodes emitting in continuous or continuous-interrupted mode at 808 nm, maximum power of 1 W for each diode, frequency of 1-2000 Hz, duty cycle of 50%; the second source consists in three superpulsed GaAs laser diodes emitting in pulsed mode at 905 nm, peak power 25 W, pulse duration of 100 ns, modulated with train of pulses synchronized with the 808nm component.

For the treatment the device settings was: frequency 1500Hz, duty cycle of 50%, 100% Intensity (average power of 2W). The scanner with spot size of 20cm^2 was positioned 20 cm above the skin, according to the manufacturer's instructions. Each lung was scanned for 14 minutes and 40 seconds, from apex to base, over an area of 250 cm^2 of the posterior thorax, resulting in 29 minutes and 20 seconds of treatment with a dosage of 7.1 J/cm^2 and a total energy of 3550 J.

The patient received once-daily treatments on 5 consecutive days. The patient was treated in the prone position with hands under the head for maximal scapular protraction to reduce the muscle and bone barrier and improve laser penetration.

At the end of the therapy, oxygen saturation level and ferritin level were 98% (free air) and 597 ng/ml, respectively.

From the chest radiography, a reduction of inflammation was evident. Both lungs appeared clear and expanded with no infiltrates. Reduction of consolidation and ground glass opacities were reported.

Date	Feb. 7th 2021	Feb. 9th 2021
Clinical course	The patient (70-year-old) was admitted to the standard department with manifestation of respiratory failure and radiographic evidence of covid pneumonia.	Start MLS® Laser Therapy (I treat)
Level of saturation	90% (free air)	95% (2l O2/min)
Ferritin level	1500 ng/ml	

Date	Feb. 10th	Feb. 11th	Feb. 12th	Feb. 13th	Feb. 15th 2021
Clinical course	MLS® (II)	MLS® (III)	MLS® (IV)	MLS® (V)	The patient was released in good general condition, by ventilating freely in the air for home care
Level of saturation					98% (free air)
Ferritin level					597 ng/ml

Figure 1:
Chest Radiography of the patient (8th Feb. 2021).

Figure 2:
Chest Radiography of the patient (15th Feb. 2021).

DISCUSSION

The clinical case mentioned in this study clearly indicates a positive effect of MLS® laser therapy in a patient with severe COVID pneumonia, symptoms of respiratory failure, cough, gagging and chest pain. The treatment was started in the very first days of hospitalization in order to effectively control the evolution of the inflammatory response. When the patient was admitted to the hospital, the oxygen saturation level (SpO2) was 90% (free air) and it was 95% (2l O2/min) on February, 9th, the day that the patient started the MLS® laser therapy. After 5 days of therapy, the results showed a significant increase of the oxygen saturation level, which improved to 98% (free air) and a positive effect of the therapy in improving the health status of the patient, with regression of symptoms. Furthermore, a ferritin blood test was performed on the patient before and after the MLS® laser therapy: the results showed a decrease in ferritin level from 1500 ng/mL to 597 ng/mL. Serum ferritin is widely recognized as an acute phase reactant and marker of acute and chronic inflammation. Higher ferritin levels have been described in Covid-19 patients with more severe disease and deceased [17,18]. Therefore, it is plausible that ferritin may be one of the useful parameter to predict disease severity and the extent of the inflammation. Even though 597 ng/mL is higher than normal, the results showed a significant decrease in ferritin level after MLS® laser therapy. Lastly, a radiographic control was performed before and after laser therapy: a significant improvement was appreciable after the 5 laser treatments.

CONCLUSION

Although related to only one patient, the outcomes of this study support the use of MLS® Lasertherapy as useful and promising therapy for the management of patients with COVID-19 pneumonia. Furthermore, it is an almost non-invasive form of therapy, with no significant side effects, that can be used as a complementary treatment of the standard drug therapy. MLS® laser therapy has the effect of relieving the acute inflammatory manifestations of the so-called cytokine storm, promoting the recovery of damaged lung tissues. It shortens the hospitalization, which translates into a lightening of the health system.

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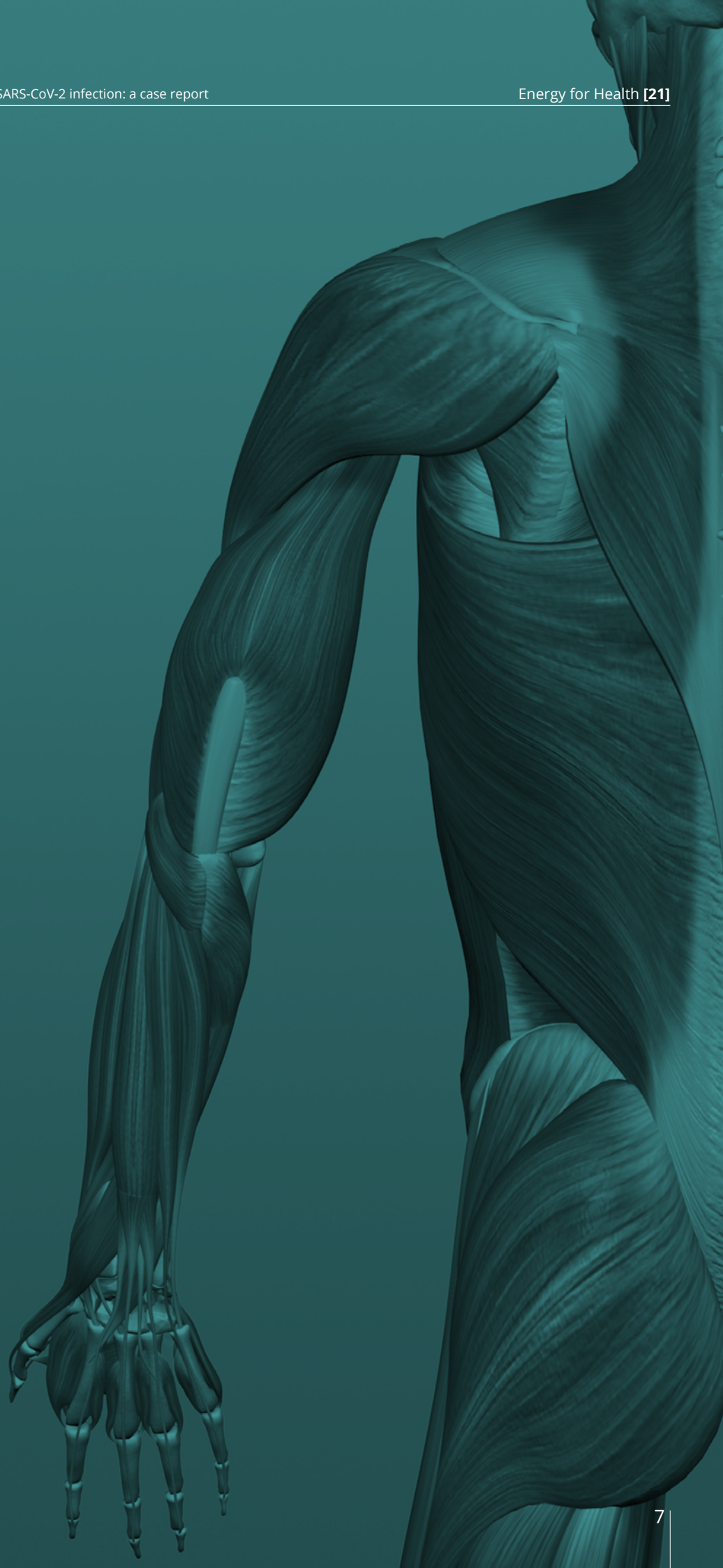

Healing of Leg Diabetic ulcer treated with MLS®-MiS laser (MiS – MLS® High Peak Pulse): a case report

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INTRODUCTION

Diabetic Lower Limbs Ulcers are frequent complications in patients diagnosed with type 2 diabetes. Diabetic ulcers lead to increased overall morbidity, such as infections, and are considered a source of emotional and physical distress. They are often resistant to conventional medical treatment, and surgery in some cases is needed. Laser therapy has been proven and largely used for many years in wound therapy, with appreciable results.

In this article we are going to deal about the efficacy and safety of laser MLS®-MiS (MiS – MLS® High Peak Pulse) in a case of chronic diabetic ulcer. Laser MLS®-MiS is a Class IV laser therapy device with high performances, which allows spatial overlap with two different wavelengths (synchronized and combined emission of a continuous emission at 808nm and a pulsed emission at 905 nm) with high peak power (1 kW). These technical characteristics allow analgesic, anti-inflammatory, anti-oedema and tissue repair effects in superficial and deep tissues. In our knowledge this is the first report of its effects in Diabetic Ulcers treatment.

CASE DESCRIPTION

The patient is a 65 years old woman, with diabetes mellitus type II, lasting for several years. The patient suffered from a chronic ulcer in her right ankle, above internal malleolus: the skin around the ulcer was red, swollen, with no significant exudation, measuring 3 cm x 2,5 cm. There was no granulation tissue, and the surface of the wound was covered by a thick fibrin layer (Figure 1).

The ulcer started 7 month before, over a basal situation of diabetic peripheral neuropathy, with cutaneous sensitivity loss. It was a typical leg ulcers, as it often happens in long-standing diabetic patients.

The ulcer had started as a little wound, arising from shoe rubbing in diabetic neuropathy, which has caused loss of cutaneous sensitivity.

The wound had progressively increased despite local dressing, and requested several antibiotic therapy over the time, for local infection. According to the Wagner Grading System, the case ulcer was Grade I, that is it did not involve ligaments, tendon or joint capsule/ fascia.

The previous local and general medical treatment lasted several months. The ulcer had become chronic and stationary, and didn't show healing anymore. The situation needed yet regular medication and specialist surveillance, without appreciable results and great discomfort of the patient.

Laser protocol: After informed consent, MiS – MLS® High Peak Pulse laser device was used. Handheld probe with optical terminal of 2 cm diameter was used, helded about 1 cm above the ulcer, dressing removed. The device program for superficial wound was chosen. Each session duration was two minutes, the used frequence was 1500 Hz, Intensity 40%. Exposure fluence of 6 J/cm^2 was delivered. As no experience was previously available in this field with MLS®-MiS laser, the treatment started at lower intensity

(30%), in order to monitor potential local initial negative effects. During the second week intensity and was increased to 40% and maintained for the following sessions. The wound was subjected to laser light exposure for a total of 20 sessions, 4 sessions/week. Both the patient and the doctor wore appropriate laser safety goggles.
After each laser session a simple ulcer medication with local silver sulfadiazine was performed, and conventional dressing was put over the wound to protect skin.
Appreciable improvement was seen after a few laser therapy sessions: surrounding inflammation gradually decreased (see in figure 2, 3, 4 the redness and swelling reduction) and a gradual size reduction was observed, till complete closure, which was reached after 20 sessions (figure 5) .
At follow up, one month and two months after the end of the sessions, the skin was completely restored and no surrounding inflammation signs were present (fig. 6, 7, respectively). No side effects were reported, and the satisfaction of the patient was high.

DISCUSSION AND CONCLUSION

High blood glucose overtime can damage nerves and blood vessels, and general metabolism disorder combined with local alterations.
Several studies show that in diabetic wounds an altered local metabolism is found, with impaired NO synthesis and angiogenesis, decreased Growth Factor and structural and functional changes in fibroblasts. Metabolic changes cause a prolonged inflammatory phase, and a consequent delay in granulation tissue formation, together with a reduction in tensile strength. Since non-healing diabetic ulcers are resistant to traditional treatment and pose clinical challenge, adjuvant therapies have been tried to stimulate healing processes.
Low Level Laser Therapy has been confirmed even in recent studies to be a worthwhile treatment in wound care and diabetic ulcers, for its anti-inflammatory and anti-oedemic activity, and tissue regeneration stimulation [1-6]. Studies report laser therapy efficacy even in severe ulcers, but it is mainly indicated in Grade I and Grade II ulcers, which represent the main part of diabetic ulcers at the first medical attention. If not correctly treated this kind of lesions can rapidly complicate, and often became chronic. A chronic ulcer is one which do not heal within 3 months, due to a stuck process in the inflammatory phase of healing. The efficacy of Class IV laser has been investigated too [7], with highly appreciable results.
MiS – MLS® High Peak Pulse laser is a new laser device which delivers a laser impulse of two wavelengths (808 nm and 905 nm) with two different emission modes (continuous and pulsed) and high average and peak power, to effectively reach deep tissue in a safe and controlled manner. The sessions were very short (two minutes).

Treatment of diabetic leg ulcers includes optimal glycemic control, removal of dead tissue from the wound, wound dressings, and systemic medical therapy in case of infection. This common treatment not always can reach wound healing, which became a chronic open wound, with a lot of medical consequences. In this clinical case we report the safety and efficacy of high peak pulse laser with specific characteristic (MiS – MLS® High Peak Pulse). The ulcer of the patient was a non-heling ulcer, which did not more react to therapies. In our patient laser treatment with laser MLS®-MiS was the only treatment adjuncted to her customary chronic therapy.
Laser treatment gradually lead to reduction of wound area, tissue granulation induction and skin repair. In our clinical case it showed efficacy and safety, and proved to be a very high manageable device, which allows very short treatment time (a few minutes), in non invasive and pain free procedure.

More reports and clinical studies will be necessary, but this high power laser device reveals as a promittig adjuvant instrument to treat diabetic wounds.

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Figure 1: pre-treatment

Figure 2

Figure 3

Figure 4

Figure 5: after 20 sessions

Figure 6: at 1 month follow-up

Figure 7: at 2 months follow-up

MLS® Laser Therapy in a dog with a recalcitrant wound suspected of being caused by a spider bite

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ABSTRACT

Poisonous arachnids may be present in some European countries and live in uncultivated lands or damp meadows or in general, can be found among the blades of grass and twigs of the bushes. [1,2] In Italy, there are several spider species as Yellow Sack spider (*Cheiracanthium punctorium*), Violin spider (*Loxosceles Rufescens*) or *Tegenaria Agrestis*, which possess dermonecrotic venom. [3] However, spider bites have only rarely been reported in veterinary medicine, mostly because, due to their secretive behavior, it is difficult to confirm their involvement in skin lesions. This case report describes the application of MLS® Laser Therapy in the management of an extended necrotic lesion in the left forelimb of an adult dog, presumably bitten by a spider in the countryside.

CASE REPORT

A 6,5 years old, neutered male Golden Retriever was presented to the emergency department of Istituto Veterinario di Novara (NO)- Italy, for the complaint of a painful and erythematous swelling of the left forelimb paw which was causing a severe lameness. The owner reported that the patient was running in the countryside and suddenly, he started yelping and then limping on the anterior limb. The initial condition was an edematous and painful distal extremity where no wound was instead detected. The patient was hospitalized and several bloodwork including a coagulation profile, pre-anaesthetic echocardiography and a CT scan were performed. No foreign bodies or bone alterations were observed, and not severe changes were revealed in the blood analysis other than those due to the ongoing inflammatory process as leukocytosis, increment of creatine kinase, c-reactive protein, and mild increase of total proteins. Despite a proper care of the patient and antibiotic therapy with a broad-spectrum antibiotic, a rapid worsening of skin conditions with ulceration and tissue necrosis spreading through the subcutaneous tissue until the scapular area was observed.

A second opinion was requested to the dermatology service that performed microscopic examination of cytologic cutaneous preparations together with microbiological cultures and multiple skin biopsies. In the meantime, a surgical debridement was carried out. Amorphous debris, neutrophils, and macrophages with a variable number of lymphocytes and plasma cells were detected together with few coccoid bacteria in cytological samples. A coagulase-negative staphylococcus was isolated from the sample, and according to the sensitivity test results under CLSI VET standards, the systemic antibiotic previously chosen was maintained. Dermatopathological findings revealed severe and deep necrosis, edema, intense mixed inflammation, both neutrophilic and macrophagic, and fibrin accumulation. All these findings supported the hypothesis of a bite, presumably due to a spider. However, the wound became difficult to manage and hard to heal and while predicting walking ability following the possibility of the forelimb's amputation, MLS® Laser Therapy (MLS® Multiwave Locked System) as a non-surgical option for accelerating the wound healing procedure and relief pain was

Figure 1

Figure 2

proposed by the dermatological service. The device used was a Class IV therapeutic laser diode device (MPHI Vet Orange, ASA Laser, Arcugnano – Italy), with the following technical features: power up to 1.2 W, Peak Power 75 W, pulse characteristics: Multiwave Locked System (MLS®) (808 nm and 905 nm-wavelength continuous and pulsed, synchronized and combined emissions), Figure 1 shows the left forelimb at time 0. Treatment duration per session was adapted to the normal clinical setting and programmed in a every other day basis. The ongoing treatment protocol was then adjusted based on several factors mostly related to the skin wound healing progression, patient's clinical status and owner's compliance. During the first two weeks, the combination and synchronization of the specific continuous and pulsed emissions of the instrument allowed to irradiate the exposed wound both in the center and then along the margins according to the infected wound protocol (Freq: CW, 100% intensity, 1,95J/cm^2). After these weeks, the protocol non-infected wound was used (Freq:584Hz, 100% intensity, 2J/cm^2). Before each laser therapy treatment, the lesion was rinsed and cleaned with sterile saline solution to remove debris from the skin and then the lesion was dried with sterile gauze to avoid excessive moisture. After each session, a soft non-woven sodium carboxymethylcellulose fibers moist-retention dressing was used. The systemic antibiotic was stopped at 30th day after starting laser therapy. The laser sessions were stopped at 120th day when almost all of the lesion was re-epithelialized (Figure 2).

METHODS

Relatively little evidence is available regarding spider bites. In the present case report a spider bite was suspected because of significant data gathered through medical history, skin lesion progression and dermatopathological findings. Other insects or reptiles such as snakes, could have been the cause of the lesion since the owners did not see what animal bit the patient. However, although in Europe and in Italy, two types of venomous Viper are found, the most common associated clinical signs are represented by variable severity of local swelling at the bite area, mental depression of short duration in most dogs, with some dogs also having transient clinical signs that could be indicative of cardiac injury and/or transient biochemical signs of liver injury. [4] In this case, our patient did not develop systemic clinical signs, nor the fangs mark could be found in the paw at the time of the clinical presentation, therefore suggesting that no snakebite occurred. The application of laser therapy helped to stop the necrosis progression and reduced the need of further surgical reconstruction and systemic antibiotics during all the wound healing process. The outcome was the preservation of the limb from any amputation with a high quality of the motility of the affected leg. Several in vitro and in vivo studies confirm that laser therapy helps to restore the biological functions of injured cells [5,6] It is observed an increased activation and production of growth factors which stimulate angiogenesis. These processes together with increased blood flow because of the vasodilatory effects of nitric oxide, may rise the oxygen supply to the wound. This enhances fibroblast proliferation and increases the granulation tissue. [6] Even there is a lack of well-designed clinical trials and studies on the use of MLS® laser therapy also in veterinary medicine, in this report there is enough evidence to justify its use in daily practice by trained clinicians.

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Alternative treatment of stomatitis in ball python (*Python regius*) with class IV laser therapy: a clinical case

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INTRODUCTION

Stomatitis (mouth rot) is a common disease in snakes. Bacterial infections tend to be associated with snake's stomatitis [4]. The bacterial agents are part of the normal microflora of the oral cavity or other parts of the digestive tract, which exhibit its pathogenic effect in periods of immunodeficiency or stressed animals [5]. Gram-negative bacteria are most commonly implicated in snake's stomatitis [6]. Clinical signs of stomatitis including anorexia, hypersalivation, pus or necrotic tissue in the mouth with erythema and swelling of gum, open-mouth breathing and death. Treatments are commonly applied with debridement, irrigation, antibiotics based on culture and sensitivity result, and anti-inflammatory drugs. However, wound of snake heal slowly and because of this, it is important to treat any sick snakes in long term. Thus, alternative treatment of stomatitis with laser therapy is needed for good outcome treatment in this case.

Laser therapy, also called photobiomodulation, involves photothermal, photomechanical and photochemical processes, occurring when the energy is absorbed by molecules (chromophores) in the tissues. The most known photochemical effect is an increase in ATP production with improvement in cell energy metabolism. Irradiation with specific light wavelengths, can result in higher availability of nitric oxide (vasodilator signaling) and production of reactive oxygen species (cytoprotective signaling) [8]. Laser radiation can induce a significant reduction of specific mediators of inflammatory response, such as prostaglandin E2 (PGE2), interleukin 1β (IL-1β) and tumor necrosis factor α (TNFα) [7]. Effects of laser therapy include: promotion of neovascularization stimulation of fibroblast migration, keratinocyte proliferation, and production of growth factors. These effects can enhance wound healing, reduce edema and infection. Thus, in this case, we evaluated the effectiveness of laser therapy in enhancing the healing rate.

AIMS

Class IV laser therapy is used extensively in veterinary medicine. It is seen as an effective alternative in reducing pain, inflammation and promoting tissue healing. The applications of therapeutic laser for treatment in various conditions have grown dramatically. This objective of this study was to evaluate the effect of laser therapy for stomatitis in a snake.

MATERIALS AND METHODS

A 2-year-old male ball python (Python regius) with body weight of 1.2 kg was brought to the exotic clinic of Kasetsart university veterinary hospital, Bangkok, Thailand, with severe inflammation of oral mucosa. The lesions showed some necrotic areas of oral mucosa and mucoid oral discharge (fig 1). This patient was diagnosed for severe stomatitis. Cause of infection has been diagnosed, based on bacterial culture and drug sensitivity test. Bacterial culture yielded positive

results for Escherichia coli and Salmonella spp. Medical treatments with antibiotic (gentamicin sulphate 2.5 mg kg-1 q72h), based on drug sensitivity result and NSAIDs (carprofen 2 mg kg-1 q 48h) were administered in this case for 14 days. The outcome was unsatisfied. Thus, alternative treatment with class IV laser therapy was considered after 7 days of medical treatment. The Multiwave locked system (MLS®, ASA srl, Italy) laser therapy was introduced for 8 treatments in 23 days. The therapeutic protocols were infected wound (2.28 joules/cm^2) and chronic inflammations (4.04 joules/cm^2). During laser therapy, the snake was covered around the eye area with thick towel to avoid exposure of the laser beam.

RESULTS

The clinical signs markedly improved after 3 times of laser therapy in 6 days (fig 3). After 8 times of laser therapy in 23 days, the inflammatory tissue was barely observed (fig 5). The necrotic tissue and oral discharge were not detected.

DISCUSSION

Laser therapy represents currently an evolution of veterinary treatment modalities. Many clinical studies shown the beneficial outcomes of using laser in reducing inflammation and infection [2,3]. The use of therapeutic laser treatment in exotic animals has also been described in many reports by exotic practitioners [10,11,12,13]. The most frequent use is on wounds, edema, pain and inflammatory-based disease [9]. Effects of laser with anti-edema, anti-inflammatory and pain relief, allow to reduce the use for drugs and accelerate the healing process [9]. Accordingly, laser therapy in snakes

Figure 1:
The first day of presentation in the hospital, this snake showed severe inflammation of oral mucosa and necrotic tissue. (Wound size 7.6 x 10.9 mm)

Figure 2:
After 7 days of treatment with injection antibiotic (gentamicin sulphate) and NSAIDs (carprofen), the improvement was hardly observed. Therefore, Multiwave locked system (MLS®) with class IV laser therapy was applied in this case.
(Wound size 7.0 x 10.1 mm)

Figure 3:
After 3 times in 6 days of class IV laser therapy, the inflammation tissue was markedly improved.
(Wound size 3.8 x 7.5 mm)

Figure 4:
After 5 times in 12 days of treatment, less necrotic tissue was noticed.

Figure 5:
After 8 times in 23 days of treatment, the inflammatory tissue was barely observed. The necrotic tissue and oral discharge were not detected.

Figure 6:
During laser therapy, this snake was covered with towel around the eyes area to avoid exposure the laser beam.

with stomatitis, that generally heal slowly, is advised. As the alternative treatment in reptiles, the outcome in this case was satisfactory and showed no undesirable effect during the procedure.

CONCLUSIONS

This report showed that class IV laser therapy was safe and effective. It can be considered as an alternative therapeutic method for stomatitis in snakes. Finally, we provided insights on the possibility to apply the laser therapy in other exotic pet treatments.

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