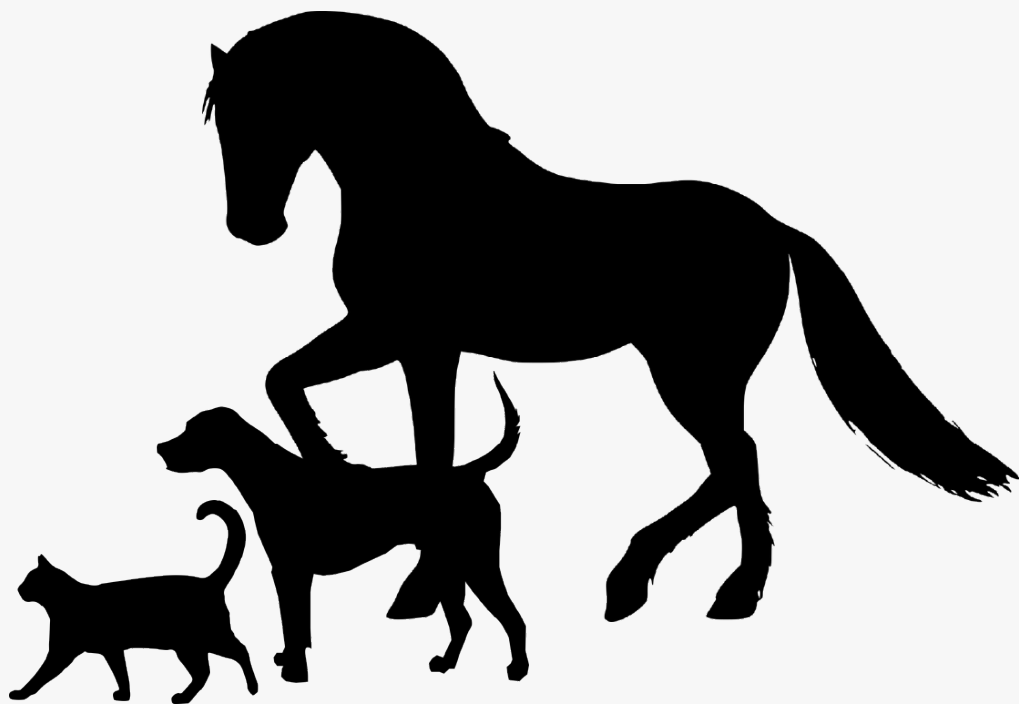


# Dosage Guideline Book



Veterinary

**Copyright © 2019 Energy Laser A/S**

No part of this user guideline can be reproduced without permission from Energy Laser A/S. Use with any form of information storage or retrieval and internet or website use is not allowed.

**Disclaimer**

Please read the guidelines carefully before using any of the information within this guideline booklet. It is the sole responsibility of the user to gain the knowledge of and comply with national laws regarding the use of Energy Lasers for any condition. The information included within this guideline is presented for informative purposes only. The conditions and dosage guidelines presented in the section "*Clinical Considerations*" should be evaluated on an individual basis for therapy as the conditions and dosage guidelines addressed is neither complete nor comprehensive. This guideline booklet is not a substitute for professional diagnosis or treatment. All persons involved with the publication of this guideline booklet explicitly disclaim any responsibility or legal liability for any kind of personal loss, risk or otherwise, which is result of direct or indirect use of any of the information in this guideline booklet.

# Contents

<b>INTRODUCTION .....</b>	<b>4</b>
<b>FREQUENTLY ASKED QUESTIONS.....</b>	<b>5</b>
How Often Do I Need to Provide Laser Therapy?.....	5
How Many Sessions Are Required? .....	5
How Quickly Are Results Evident? .....	5
Can I Combine Laser Therapy with Other Forms of Treatment?.....	5
Are There Any Side Effects? .....	5
Why Are There Choices of Wavelengths? .....	6
<b>LASER LABEL TERMINOLOGY .....</b>	<b>6</b>
<b>EQUIPMENT AND TREATMENT EFFECT .....</b>	<b>7</b>
LED vs. Class 3B Lasers .....	7
Class 4 Lasers vs. Class 3B Lasers.....	7
<b>TREATMENT GUIDELINES.....</b>	<b>9</b>
<b>SAFE LASER USE.....</b>	<b>10</b>
Eye Protection .....	10
Laser Power Scheme.....	11
Energy Absorption of Special Green Protective Eye Goggles.....	11
<b>ABOUT LASERS .....</b>	<b>12</b>
How is Laser Light Produced? .....	12
Power Setting Influence .....	13
<b>HOW DOES LASER LIGHT INTERACT WITH CELLS? .....</b>	<b>14</b>
What is Photobiology? .....	14
Pathways .....	14
Mechanism.....	14
Parameters .....	15
<b>TREATMENT TECHNIQUE .....</b>	<b>16</b>
Point Treatment Technique .....	17
Scanning Technique .....	17
Treatment of Wounds.....	17
<b>CALCULATING DOSAGE &amp; ENERGY DENSITY.....</b>	<b>18</b>
<b>PATIENT PREPARATION AND DOSAGE CONSIDERATIONS.....</b>	<b>19</b>

ASSESSING NEW PATIENTS .....	19
DOSAGE CONSIDERATIONS .....	20
DOSAGE EXAMPLES .....	21
TREATMENT FREQUENCY .....	21
CLINICAL CONSIDERATIONS .....	22
<i>Pre - Laser Diagnosis &amp; Assessment Examples</i> .....	22
<b>LASER SELECTION .....</b>	<b>22</b>
<b>DOSAGE GUIDELINES.....</b>	<b>23</b>
EQUINE DOSAGE GUIDELINES .....	23
<i>General Equine Dosage Guidelines</i> .....	24
<i>Specific Equine Dosage Guidelines</i> .....	26
Head.....	26
Throat.....	28
Cervical Spine and Neck.....	29
Shoulder .....	30
Upper Arm and Forearm .....	31
Carpus and Metacarpus.....	32
Fetlock and Pastern.....	33
Hoof .....	34
Back.....	36
Hip, Pelvis and Upper Hind Limb .....	37
Stifle.....	38
Tarsus and Metatarsus.....	39
Wounds .....	41
CANINE DOSAGE GUIDELINES.....	44
<i>Specific Canine Dosage Guidelines</i> .....	45
Wounds .....	45
Dermatological Soft-Tissue Conditions.....	47
Musculoskeletal Conditions .....	50
Head.....	52
Neck and Back .....	53
Shoulder .....	54
Hip.....	55
Elbow .....	56
Knee/Stifle.....	57
Hock/Ankle.....	58
Carpal/Wrist .....	59
FELINE DOSAGE GUIDELINES .....	60
<i>Specific Feline Dosage Guidelines</i> .....	61
<b>REFERENCES .....</b>	<b>64</b>

# Introduction

Energy Lasers use specific wavelengths of laser light to effectively stimulate key molecules in the animal's tissue. Years of Veterinary research has identified the ideal wavelengths, power levels and frequencies. These positively stimulate cellular metabolism, accelerating and enhancing the animal's own natural healing processes and reparative abilities.

The laser light penetrates deep into the musculoskeletal tissue and accelerates cell metabolism by increasing local blood flow, nutrient absorption, and cell division. It also expedites the excretion of local waste products. Skin, tendon, ligament, muscle, and nerve tissue heal faster with less pain, inflammation and scarring.

Therapy lasers have become an integrated tool in many veterinary practitioners' toolbox. Laser therapy used for pain management and *Photobiomodulation (PBM)* is approved as a recognized medical treatment. More than 6000 published, scientific studies and clinical trials worldwide have been presented, supporting the significant effect of the treatment with laser therapy on a variety of conditions.

There is an increased awareness about the necessity to deliver low doses over longer time to optimise anti-inflammatory results <sup>(1)</sup>. This means that, at least for healing processes, low power over long time is more effective than high power over short time, for stimulation of cell proliferation.

## Energy Laser Key Benefits:

- Stimulates the animal's natural immune system
- Produces a systemic analgesic effect
- Enhances the local circulatory system
- Improves Local nerve function
- Improves vascular activity
- Reduces Fibrous Tissue formation
- Increases Metabolic activity
- Induces Analgesia (Pain Reduction)
- Aids Immunoregulation
- Provides Trigger Points & Acupuncture Point Therapy
- Reduces Oedema
- Expedites tissue repair with reduced scarring in wounds, burns, injuries
- Expedites post - surgical patient recovery.

Laser Therapy is an established and effective treatment modality following many years of scientific studies conducted upon both animals and humans. Hundreds of rigorous medical studies document the efficacy of laser treatment used within pain management and clinical rehabilitation.

## Frequently Asked Questions

### How Often Do I Need to Provide Laser Therapy?

Acute conditions may be treated daily, especially if the patient is in significant pain. Chronic problems respond better when treatment is provided two or three times a week, tapering off to once a week or once every two weeks as improvement is noticed or as and when required.

### How Many Sessions Are Required?

This will depend on the nature of the injury or condition. Acute conditions may require five or more laser treatment sessions. Chronic conditions often require ten or more sessions. Cases of severe arthritis may require ongoing periodic treatment to provide and maintain drug-free pain control. It should be noted that laser therapy dosages are cumulative, and patients often require several sessions of laser therapy to achieve the chosen dosage.

### How Quickly Are Results Evident?

A reduction of pain and an improvement in joint mobility is often noticed after the first or second exposure to laser light. Occasionally the patient may feel worse one day after treatment. This is commonly associated with the animal's natural *inflammatory response* and usually settles down within a day or so as the healing progresses.

### Can I Combine Laser Therapy with Other Forms of Treatment?

Yes. Energy Laser therapy is often used in conjunction with other treatment modalities.

### Are There Any Side Effects?

Very few '*side effects*' have been reported since Laser treatment became popular. Old injuries or pain syndromes may feel aggravated for a day or two post laser treatment. This is due to the healing response activated by the laser and can be considered a transient state.

## Why Are There Choices of Wavelengths?

The wavelength of the laser will dictate not only the colour of light emitted, but also dictates how 'deep' the light (photons) will penetrate and go through tissue. The greater the wavelength, the deeper the laser will penetrate the patient.

Lasers are often used to treat surface wounds and shallow ailments, so it would be preferable to select a wavelength that does not penetrate deeper than what may be required to treat effectively. Conversely, select a wavelength that penetrates deep enough into tissue if a deeper delivery of energy is required. i.e. hip joints, and dense muscle structures in the larger animals such as horses and large dog breeds.

## Laser Label Terminology

- Laser Diode – Type of Laser
- Visible Wavelength - Measured in nm (nano-meters)
- Wave Type- CW = Continuous Wave (no pause between photons emitted)
- Power Output mW = Milli-watts. (The higher the power - the faster the laser can produce & emit photons to deliver required energy to the cells)

All lasers used in veterinary and human medicine and even industry are classified by their *power output*. Veterinary and medical lasers are usually Class 3b or Class 4.

If a laser exceeds 500 mW of energy output (via one lens) it is classified as Class 4. Lasers of this power range may cause permanent blindness, if accidentally shone onto the patient's Retina, and severe burning of tissue/skin can also occur.

## Equipment and Treatment Effect

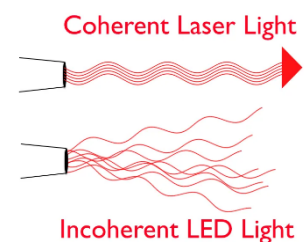
### LED vs. Class 3B Lasers

There is a lot of different devices on the market being sold for laser therapy. LED devices are often referred to as laser therapy devices but differs on several points from “real” LASER devices. LED stands for ***Light-emitting Diode***. A diode that emits light when electricity passes through it, often in pretty colours. LASER stands for ***Light Amplification by Stimulation of Emitted Radiation***. A source of light is amplified within a gain medium and emitted in a specific way.

Lasers are monochromatic. This means that the light produced by a laser is a single, specific wavelength. LED’s also tend to produce monochromatic, or nearly monochromatic light.

Lasers concentrate all their power in a small point. Laser light is coherent and coherent light can be transmitted over much greater distances than incoherent light. LED’s tend to distribute their power over a larger area, but without the traveling effect of laser.

LED effects tend to remain local, affecting the local tissues that are exposed to the light. Because they are not coherent, they can safely use higher power without danger to eyes and skin. LED’s are great for treating larger areas and affecting local tissues.



### Class 4 Lasers vs. Class 3B Lasers

Many Class 4 laser companies market their lasers by first and foremost talking about false limitations of Class 3B lasers.

Certain Class 4 manufacturers use the limited knowledge of their customers in their marketing to claim that a Class 4 laser has greater efficacy than a Class 3B laser. This is very far from the truth. Laser classification is only used to determine the possible risk for eye and skin damage and has nothing to do with the efficiency in treatment. Laser classification is not just a question of optical output power, it is also determined by wavelength, divergence of the beam, emission area, pulsing parameters, exposure rates, etc. There are Class 1 lasers that are higher powered than many Class 4 lasers, so there is no sense in or reason for, other than deception, the term “Class 4 laser therapy”.

High-powered lasers are useful for treating large areas in short time and to obtain pain inhibition, but seemingly less effective for basic cell stimulation. They do not penetrate much deeper due to the high output – in fact, the very act of making a high powered laser “safe” for long-duration exposures, may make it less capable of penetrating as deeply as a lower-powered laser that can e.g. be applied in contact and with slight pressure to the

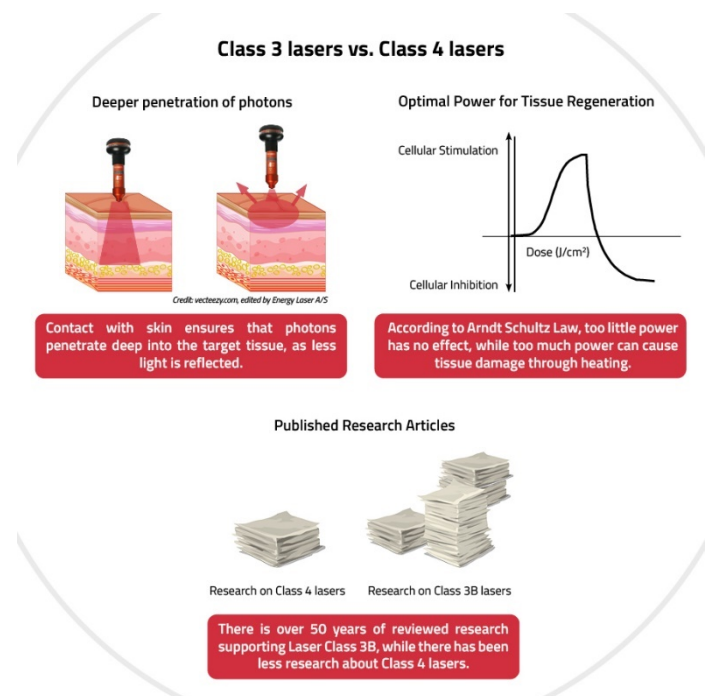


skin. The very high-powered lasers are still lacking scientific documentation despite their increasing popularity with salesmen and their customers, who are possibly less informed.

CW lasers have an excellent and immediate effect on pain <sup>(2, 3, 4)</sup>, inducing analgesia directly by interrupting the transmission of pain signals to the brain; and pulsed 904 nm lasers are fine for reducing oedema <sup>(4, 5)</sup> and, secondarily, relieving pain. A literature review by Hashmi <sup>(5)</sup> finds very little support for specific effects of pulsing, other than that of the high peak power of the super pulsed lasers.

Therefore, one thing is still certain, current scientific and clinical research proves that Class 3B lasers are the best lasers suited for therapeutic applications.

- Both Class 3B and Class 4 lasers can deliver the same number of Joules
- A Class 3B laser will take slightly longer time to deliver the required number of Joules  
This is not necessarily a bad thing. Studies have shown that low doses and long-time is more effective for the reduction of inflammatory processes, whereas high power and short time are inhibitory, helping with acute pain, but the actual healing is slower
- Class 3B lasers do not produce heat, so it can be used with contact and pressure to the skin. With contact, more light is forced into the tissue
- By using pressure, blood, being the main absorber of the light, is reduced in the area and the light can more easily penetrate the tissue
- The pressure will also lead the laser probe closer to the target. Thus, a Class 3B laser can penetrate deeper into tissue than a Class 4 laser



## Treatment Guidelines

The treatment and dosage guidelines in this guideline booklet originate from the listed references as well as clinical experience with the use of the lasers from Energy Laser A/S. For further information on your Energy Laser, see the datasheet in the App.

Our lasers operate with two different wavelengths 660 nm red light and 808 nm Infrared light. These two wavelengths have been chosen based on existing clinical evidence on treatment of a variety of applications including wounds and skin disorders, scar tissue, muscles, tendons, and joints.

When using laser therapy, it is important to note that dark skin, or any other pigmentation on the skin, including moles and tattoos, will absorb a greater proportion of the laser energy. It is important to get feedback from your patient as to their comfort level.

When treating a pigmented area with the laser, the scanning technique is the most suitable technique. It is also wise to reduce the power on the laser or simply move the laser further away from the patient's skin. This will reduce the possibility of thermal discomfort.

Please read and refer to the user manual for operating instructions and other safety requirements.

### Laser therapy contraindications, special considerations, and precautions <sup>(7)</sup>



#### Absolute Contraindications

- Eye exposure

#### Precautions

- Active epiphyses
- Haemorrhage
- Testicles
- Thyroid gland

#### Special Considerations

- Locally injected medication
- Malignancy
- Pregnancy

#### False Contraindications

- Hyperpigmentation and tattoos
- Implants
- Microbial infection
- Photosensitizing medications

## Safe Laser Use

- Do not use lasers directly on or near an animal's abdomen if it is pregnant, or if this is suspected (Eggs or live young)
- Always ensure that the patient is always protected, or wear laser safety goggles matched to the laser's wavelength, when there is the slightest risk of direct illumination of the eyes
- Avoid treating directly on glands that produce hormones (e.g. Thyroid, or suspected areas of skin carcinoma/melanoma)
- Consider the patient's skin colour (also consider fur colour and density) prior to laser introduction, including fur, scales, thickness, colour etc and adjust treatment times accordingly. Be precautionous using laser on tattoos
- Never treat directly onto a bleeding wound. Wait for it to clot prior to beginning of laser therapy treatment
- Do not place the tip of the laser directly upon an 'open' wound

**Note:** It is usually safe to use laser therapy on medical implants such as orthopaedic implants and plastic joints, as well as pacemakers and other medical implants.

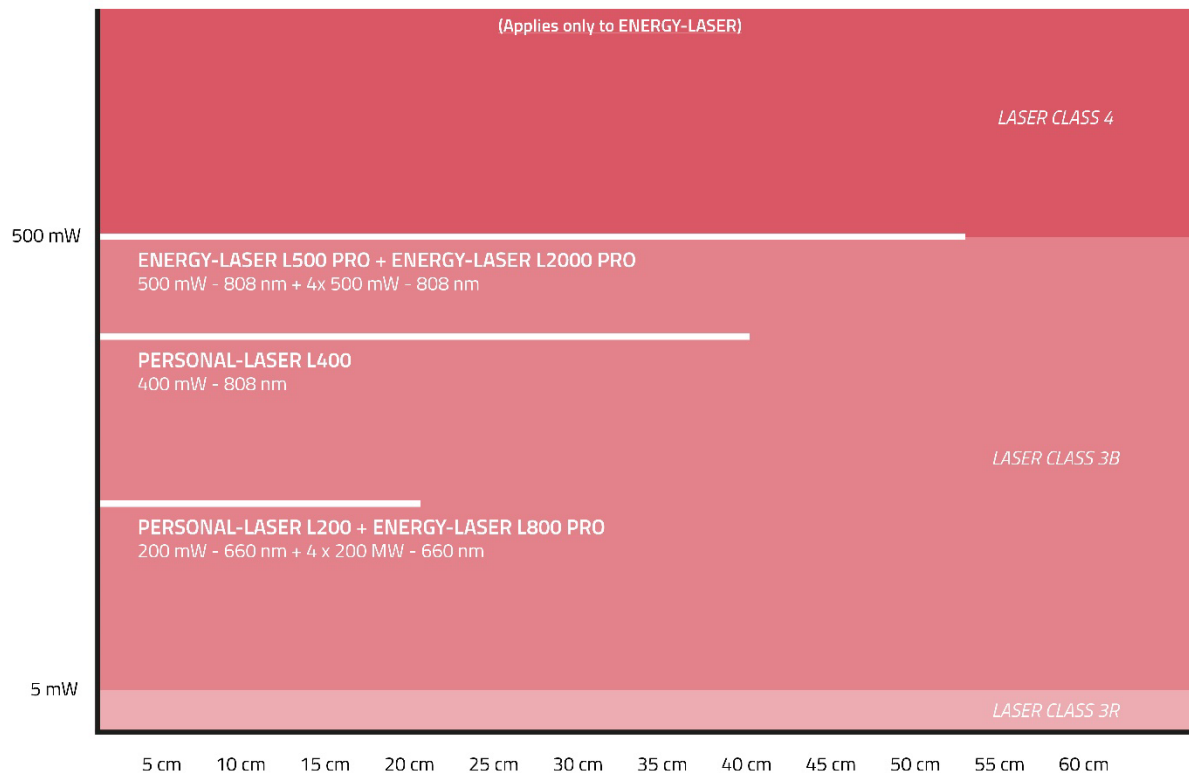
## Eye Protection

In accordance to the standard EN 60825, one should use protective eyewear when there is a risk of direct illumination of the eyes and the laser energy is in Laser Class 3B.

Most PBMT laser equipment emits laser light with divergence and the laser energy is already at short distances substantially reduced, but still in Laser Class 3B. As the person providing the treatment will never look directly at the laser light during treatment, it is not necessary to use protective eyewear!

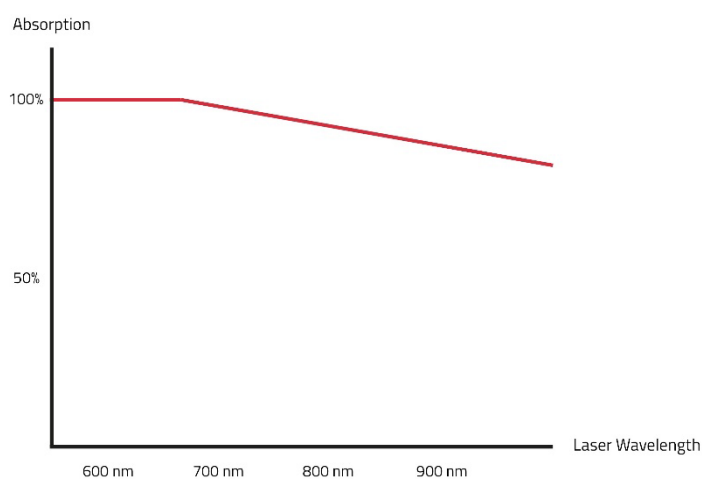
The patient should however be protected against laser light if the face is being treated or the patient can look directly into the laser light. Protection of the patient can be done by screening with a body coloured plastic screen, wet cloth laid across the eyes, dark sunglasses (should be tested for absorption first) or special green protective eye goggles, which are particularly good at absorbing the laser light (included with the laser).

## Laser Power Scheme



Distance measured from laser diode, laser tip, optical fibre, or collector lens. Power measurements are made using Molecron POWER MAX 500AD Laser Power Meter.

## Energy Absorption of Special Green Protective Eye Goggles

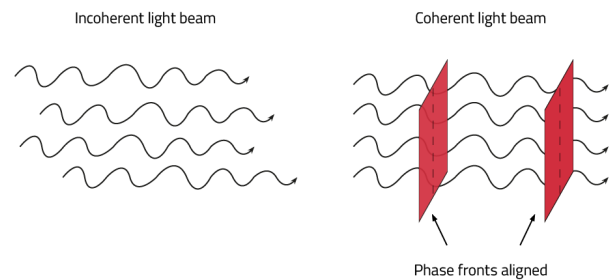


Measurements carried out using Molecron POWER MAX 500AD Laser Power Meter shows that the laser energy from 660 nm absorbs 100% and from 808 nm the laser energy absorbs 96 % by direct illumination on the green special glasses.

## About Lasers

The word LASER stands for *Light Amplification by the Stimulated Emission of Radiation*.

- Laser light is a non-ionising form of energy that is part of the electromagnetic spectrum
- Electromagnetic energy travels in waves
- Unlike ordinary light, laser light waves are in sync with each other. The 'peaks and troughs' of each wave are on top of each other providing reinforcement, and they help to propagate each other. This is called 'coherence'
- Laser light travels in straight lines and does not diverge
- Laser light is '*mono chromatic*', meaning it is of one colour (wavelength). It is for this reason that laser light can be specifically targeted to act upon certain tissue types



## How is LASER Light Produced?

A medium, composed of atoms capable of reaching an excited state is required. An external energy source is used to excite the atoms. When they regain their stable state, the atoms give off energy in the form of photons (Light Energy). The photons are corralled into a resonating chamber with mirrors at either end. As the number of atoms reach a peak, the photons produced spontaneously cause the stimulation of other atoms causing them to release their photon energy. The resultant laser light is directed to the laser's lens.

Laser light in the red, and near infrared range has 'bio-stimulatory' properties. These wavelengths correspond to wavelengths between 600 nm and 1000 nm. These 'shorter wavelengths' are more readily absorbed superficially, but **do not** reach the 'deeper' layers of the patient's tissue.

It is for this reason that having a variety of wavelengths available in your practice is beneficial. The wavelength of the laser primarily determines laser-light tissue penetration. There are subtle differences in the biological effects of differing wavelengths. Treating superficial wounds requires a 600 nm - 750 nm wavelength laser, deeper tissue, musculoskeletal for example, a laser with a longer wavelength between 750 nm - 1000 nm would be more capable of reaching the deeper and more dense tissue target structure.

## Power Setting Influence

We have learnt the importance of having a selection of wavelengths to choose from when treating patients to reach the depth of photon penetration we may require; however, we now need to discuss the importance of the POWER aspect of lasers.

Laser power is measured in Watts (W). It is the Wattage of a laser that will dictate how quickly the photons are produced, and subsequently delivered to the tissue. The higher the 'Wattage' the quicker the laser will produce and deliver the required 'dosage' of energy prescribed to the patient. The 'Dosage' of energy is measured in Joules (J).

To illicit an effective and positive outcome to laser therapy, a sufficient dosage must be administered. One of the biggest reasons for poor therapeutic outcome following laser therapy is due to underdosing, not-overdosing.

**'Power Density'** must be taken into consideration. This is measured in (Watts/cm<sup>2</sup>). The laser's lens causes the photons to diverge as they leave the laser.

## How Does Laser Light Interact with Cells?

Photobiomodulation (PBM) therapy is defined as the utilization of non-ionizing electromagnetic energy to trigger photochemical changes within cellular structures that are receptive to photons. Mitochondria is particularly receptive to this process. At the cellular level, visible red and near infrared light (NIR) energy are absorbed by mitochondria, which perform the function of producing cellular energy called "ATP". The key to this entire process is a mitochondrial enzyme called cytochrome oxidase c, a chromophore, which accepts photonic energy of specific wavelengths when functioning below par.

## What is Photobiology?

Photobiology is the study of the effects of non-ionizing radiation on biological systems. The biological effect varies with the wavelength region of the radiation. The radiation is absorbed by molecules in skin such as DNA, protein, or certain drugs. The molecules are changed chemically into products that initiate biochemical responses in the cells.

Biological reaction to light may occur, there are many examples of light induced photochemical reactions in biological systems. Vitamin D synthesis in our skin is an example of a photochemical reaction. The power density of sunlight is only 105 mW/cm<sup>2</sup> yet when ultraviolet B (UVB) rays strike our skin, it converts a universally present form of cholesterol, 7-dehydrocholesterol to vitamin D3.

This is normally experienced through our eyes, which are of course photosensitive. Our vision is based upon light hitting our retinas and creating a chemical reaction that allows us to see. Throughout the course of evolution, photons have played a vital role in photo-chemically energizing certain cells.

## Pathways

- NO (*Nitric Oxide*)
- ROS (*Reactive Oxygen Series*) → PKD (*gene*) → IκB (*Inhibitor κB*) + NF-κB (*nuclear factor κB*) → NF-κB (*nuclear factor κB stimulates gene transcription*)
- ATP (*Adenosine Triphosphate*) → cAMP (*catabolite activator protein*) → Jun/Fos (*oncogenic transcription factors*) → AP-1 (*activator protein transcription factor stimulates gene transcription*)

## Mechanism

The current and widely accepted proposal is that the low level visible red to near infrared light (NIR) energy is absorbed by mitochondria and converted into ATP for cellular use. In addition, the process creates mild oxidants

(ROS), which leads to gene transcription and then to cellular repair and healing. The process also unclogs the chain that has been clogged by nitric oxide (NO)<sup>[1]</sup>. The nitric oxide is then released back into the system. Nitric oxide is a molecule that our body produces to help its 50 trillion cells communicate with each other. This communication happens by transmission of signals throughout the entire body. Additionally, nitric oxide helps to dilate the blood vessels and improve blood circulation.

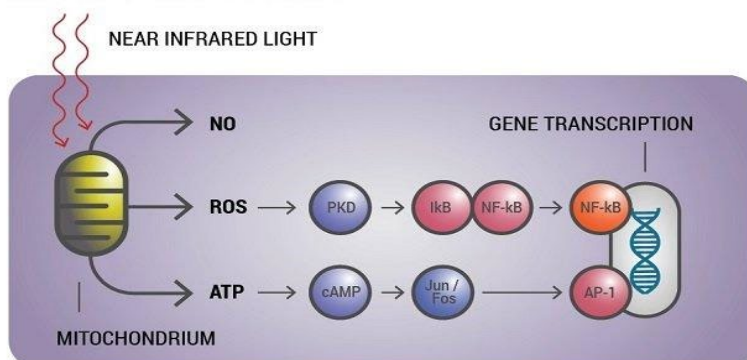
## Parameters

The correct wavelength for the target cells or chromophores must be used (633-810 nm). However, if the wavelength is incorrect, optimum absorption will not occur. Thus, as the first law of photobiology, the Grotthus-Draper law, states - without absorption there can be no reaction.

The photon intensity, i.e., spectral irradiance or power density ( $W/cm^2$ ), must be adequate, or absorption of the photons will not be sufficient to attain the desired result. However, if the intensity is too high, the photon energy will be transformed to excessive heat in the target tissue, and that is undesirable.

Finally, the dose or fluence must also be adequate ( $J/cm^2$ ). Consequently, if the power density is too low, then prolonging the irradiation time to achieve the ideal energy density, or dose, will, most likely, not give an adequate result. This happens because the Bunsen-Roscoe law of reciprocity, the 2nd law of photobiology, does not hold true for low incident power densities. The laser therapy settings listed below are included herein to offer a suggested starting point for therapy application using the Energy Laser Models L2000 PRO, L800 PRO, L500 PRO. All Energy Laser devices emit their light in a 'Continuous' output waveform. The Power settings of each laser is adjusted by using the Energy Laser mobile application (IOS and Android) which are downloaded from Google Play or App store-free of charge.

### CELLULAR MECHANISMS



Reference: "Basic Photomedicine", Ying-Ying Huang, Pawel Mroz, and Michael R. Hamblin, Harvard Medical School.



## Treatment Technique

A Class 3B laser is a helpful tool used for reducing pain and inflammation related to a variety of conditions. Furthermore, Laser Therapy uses light to promote healing by improving blood flow and restoring normal cell function to speed up the body's natural healing process.

Making a correct diagnosis before initiating PBMT is crucial and therapy must be applied to the localized area of the diagnosed condition. For increased clinical result and a faster recovery PBMT should be applied to secondary and tertiary compensatory areas, as well with the appropriate technique, dose, and frequency.

It is wise to record a baseline to map all the areas to be treated and to keep track of the treatment progress before initiating the therapy. This can be done by photos and/or digital thermographic images combined with your standard clinical assessments.

The guidelines listed in this booklet are based on user experience and published clinical studies. As a user, you will develop individual protocols based on your own experience, type of practice and variety of patients you see.

Treatment should be delivered to exposed skin. **DO NOT PERFORM TREATMENT THROUGH CLOTHING, BAND AIDS OR BANDAGES** as the composition and colour in these materials vary and will absorb some of the laser light making the treatment less effective or even cause heat.

Hold the Energy Laser perpendicular to the treatment area/surface.

The guidelines in this booklet are designed to show areas to be treated and dosages for specific indications. In general, dosages are delivered to the area of pain, the surrounding tissues, and along the nerve pathway for the specific area experiencing pain.

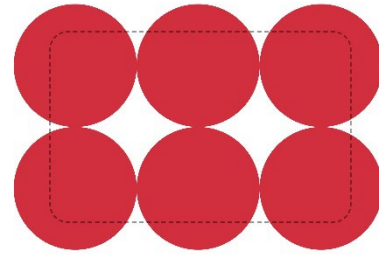
### **When applying PBMT a few key points should be noted:**

- Keep the laser vertical to the skin. Deflection of the beam will result in an increase in the reflection of the light energy
- Whether you are using point treatment technique or scanning technique, treat with skin contact if possible. This eliminates a great deal of the reflective loss of energy from the skin, allowing more energy to enter the tissue. When making a slight pressure into the skin with the laser some of the blood supply in the area is removed, which lower the absorption of the energy from haemoglobin and oxyhaemoglobin
- Independent of the treatment technique used, always drag, or place your finger next to the lens when you treat. This provides an easy temperature monitor of the tissue being treated
- Apply laser therapy at the right angle and in opposite directions, as it allows the energy to be applied evenly throughout the treatment area
- The medical record should note the clinical progress, total amount of joules given to each area, treatment technique and a plan for the next session

## Point Treatment Technique

Point treatment is carried out by moving the laser from point to point with 1 – 2 cm in between each beep (10 sec.).

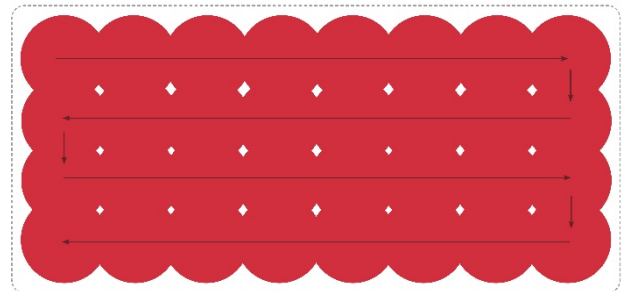
When treating wounds and eczema the laser should be held at distance of 1 cm from the skin. When reaching skin just outside of the area of injury one can gently press the skin with the laser optics again.



## Scanning Technique

The scanning technique is used with a spread laser lens attached to the laser light. The scanning technique is used when treating the area around the target, when treating larger areas (wounds, eczema, psoriasis, etc.) and especially when treating areas with dark skin, dark hair follicles or pigmentation and tattoos.

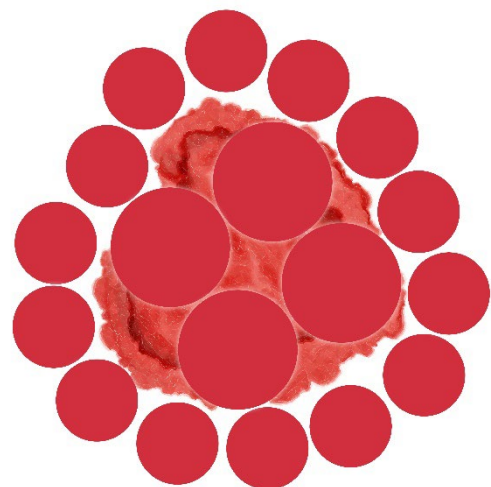
The process is carried out by pressing the optics of the laser onto the skin, while the laser is moved in rectangular or circular movements on and around the affected area.



## Treatment of wounds

Treat with contact along the margins of the wound ( $4 \text{ J/cm}^2$ ) using either point or scanning technique. Without contact treat the area inside the wound ( $0,5\text{--}1 \text{ J/cm}^2$ ). Hold the laser approx. 1 cm above the wound and use either point or scan technique.

In CW (Continuous Wave) mode at 500 mW power, a laser will output 30 Joules of energy into the tissue in one minute. As an example, a patient with chronic tendon pain (Tendonitis) may require a treatment dose at  $10 \text{ J/cm}^2$ . With a treatment area of approximately  $12 \text{ cm}^2$  the treatment will take approximately 4 minutes with a L500 PRO laser and 1 minute with a L2000 PRO laser.



## Calculating Dosage & Energy Density

To calculate dosages of energy density we must express the units in standard units; we know that the power of a laser device is measured in Watts and we know that one milliwatt is 1/1000 of a Watt. We must also change minutes to seconds.

We must convert the Milliwatts (mW) to Watts before we do dosage calculations. Power is the time rate of delivery of energy, so power, energy and time are all related.

Therefore - **Power = Energy/Time**

You can calculate the energy delivered by multiplying the power by the time. For example, the energy delivered by a 500mW laser in 3 minutes would be...

$$\text{Energy (Dosage Delivered)} = \text{Power} \times \text{Time} = 0.5W \times 120s = \underline{60 \text{ Joules (J)}}$$

To calculate the Energy Density, simply divide the energy delivered (J) by the area in square centimetres.

$$\text{Energy Density} = \text{Energy/Area (J/cm}^2\text{)}$$

Power Unit	= Watts (W)
Area	= cm <sup>2</sup>
Energy	= Jules (J)
Energy Density	= Joules per square centimetre (J/cm <sup>2</sup> )

### Calculating Energy Density

Area	Energy	Energy Density
100cm <sup>2</sup>	60J	0.6 J/cm <sup>2</sup>
7.5cm <sup>2</sup>	60J	8 J/cm <sup>2</sup>
0.5cm <sup>2</sup>	60J	120 J/cm <sup>2</sup>

Remember, if the energy density is too low, it **will not** bio-stimulate tissue, but if it is too high you may damage tissue or inhibit healing.

## Patient Preparation and Dosage Considerations

It is always wise to consider why laser therapy is indicated for this specific condition before you start a treatment. Expectations to the clinical outcome should be considered and shared with the owner of the animal if you are not the owner. It is important to inform the owner that there are no side effects, and cells that are functioning normally, are not affected. Realistic therapeutic goals and a plan for the treatment should be outlined as well.

The surrounding environment should be relaxed and pleasant with comfortable lightning. The skin, fur/hair must be clean and free of materials that can absorb the light (dust, dirt, lotions, and ointments). Wounds must be cleaned and without infection before applying laser therapy. The patient/animal should be positioned in a comfortable position that allows the therapist access to the area or areas to be treated. Treatment close to the head or when there is the slightest risk of exposure to the eyes, eye protection for the patient/animal must be applied (goggles, black towel, or black fabric).

During treatment, the patient/animal should not feel any thermal discomfort, or excessive heat on the skin or fur/hair. Feedback from the patient/animal is critical. As it is not possible to instruct the patient/animal in telling the user of the laser, if they feel discomfort or heat during the treatment, the user has to look for signs from the patient/animal indicating that they are comfortable; and by all means be careful not to use too high power on especially dark skin and fur/hair. If the patient/animal expresses any discomfort, the power output should be reduced. When treating animals, it is highly recommended to use the Vet Optics, available for L500 PRO and L2000 PRO lasers, to lower the risk of heating or burning the patient/animal.

By using the "Scanning technique", heat will not build up in any specific point or area. Pulling the laser further away from the surface of the skin will also decrease the power density. However, this it is not recommended as you will lose too much of the laser's energy due to the reflection in the skin and fur.

When treating over heavily pigmented skin and/or tattoos you should decrease the laser power significantly and move the laser faster by using the "Scanning technique" and/or pull the hand piece away from the skin.

In cases where the patient has no, or limited sensation, and is not able to respond to an increase in temperature, treat at a lower power setting.

## Assessing New Patients

### Basic Considerations/Notes

- Fur density, length & colour
- Patient's current drug and surgery history/allergies/ overall general condition
- Age of animal & age of injury
- Signs of infection & previous surgery evidence (Scars)

Assessing the patient is important in determining which laser wavelength to choose and the initial power settings to begin treatment with.

When treating dark skinned or dark furred animals it is wise to start the laser on a low-power setting to avoid heating of the fur or skin and treat these skin types over a longer period of time at a lower power.

If the animal has a surface injury or a shallow injury, then a lower wavelength laser may be all that is required.

It has been proven that a 'gentler' approach and prolonged exposure to laser light of a lower power has produced better results than treating with high power over a shorter period. It would also benefit the patient if they are new to the experience of laser therapy.

It should be noted that most laser therapy fails due to under treatment than of over treatment. The selection of the incorrect laser wavelength and incorrect power setting and dosage delivery is also responsible for 'non – responsive' patients.

## Dosage Considerations

Animals come in all shapes and sizes; it can be confusing to those new to PBMT. *"What dosage do I give and what power setting do I use in this case?"* are questions frequently posed.

Dosages are determined by the anatomical areas, whether the wound is open or closed, its age, the tissue involved, the distance to the target tissue and the presence of infection or contamination. Remember that there is a large margin of safety, and if too little dosage is administered there will be no clinical benefit of the treatment. Remember that you must supply a sufficient energy dose to illicit a biological and physiological response in your patient.

In order to deliver the needed dosage that we have calculated we must also consider the following factors: Wavelength selection, power density required, tissue type and condition, skin pigmentation, treatment technique etc, however, there is a 'therapeutic dose window'.

In their text referenced below, Tuner & Hode suggest an energy density of 2-4 J/cm<sup>2</sup> for superficial pain and 4-10 J/cm<sup>2</sup> for deep underlying pain <sup>(7)</sup>.

## Dosage Examples

Delivering the correct dosage to the tissue is key to successful laser therapy treatment. An insufficient dosage will have little or no effect at all, and too much exposure may inhibit healing and worsen the condition.

Healthy cells and tissue can be treated with almost any dosage of laser therapy with few, if any, noticeable adverse reactions. However, injured, or damaged cells and tissue absorb photon energy far more readily than healthy cells. This should not be interpreted as a '*just fire away*' style of treatment with impunity, since it is best to operate within set treatment protocols as the examples below illustrates.

Condition	Dosage J/cm <sup>2</sup>
Superficial Wound	1 - 2
Superficial Pain	2 - 4
Acute Deep Pain	4 - 6
Chronic Deep Pain	6 - 10

## Treatment Frequency

The frequency of treatment with laser therapy is different from case to case depending on the patient, compliance and the response/reaction to the treatment. PBMT can generally be divided into these three phases <sup>(8)</sup>:

1. **Induction phase:** Aggressive phase where therapy is applied on repeated days or every other day until a significant clinical response is noted. After a therapy session we are always looking to achieve a treatment reaction.
2. **Transition phase:** Therapy is applied less often until the treatment goal is reached e.g. twice a week.
3. **Maintenance phase:** Therapy is applied as frequently as needed to maintain the treatment goal or quality of life over long period of time.

How the three phases are scheduled depends on whether the condition being treated is acute or chronic.

- **Acute condition:** Daily treatment until considerable clinical response is observed. Then treat less frequently until the condition is solved.
- **Chronic condition:** Treatment 2-3 times/week for several sessions until a clinical response is observed. Then treatment less frequently until the therapeutic goal is achieved. Lastly, periodically treatment to maintain the therapeutic goal.

## Clinical Considerations

The list below can act as an aid to the thought and decision process when considering using laser therapy on a patient. Assuming the patient is considered a suitable candidate for laser therapy.

### Pre - Laser Diagnosis & Assessment Examples

- Is the area to be treated post - surgical?
- How old is the patient, history of medication is noted?
- Is the wound superficial or deep?
- Has the area stopped bleeding?
- Has the pain been diagnosed as acute or chronic (if no wound present)?
- Is the pain a result of Tendon/Ligament/Tissue or Bone damage?
- What current medication is the patient taking? (avoid steroids prior to laser therapy where possible)
- Will the patient be compliant and settled?
- Can the patient attend regular laser therapy at the clinic?
- Will I need to shave the treatment area? (shave thick/dense fur) Cats/ Dogs/Rodents etc.

## Laser Selection

Energy Lasers are offered as single wavelength lasers at set wavelength and the laser light is delivered in a continuous waveform (CW). Adjustment to the power setting and treatment time can be made using the Energy Laser App.

Note, we must first decide what wavelength is ideally suited to treat the patient. A 'shorter' wavelength (660 nm) is suitable for superficial wound treatments. Deep tissue penetration will require a laser with a longer wavelength (808 nm). It is simply a case of choosing the right instrument for the job.

Energy Laser Wavelengths	
660 nm	808 nm
Suitable for superficial wound treatments	Suitable for deep tissue penetration

## Dosage Guidelines

The following are treatment recommendations only. The guidelines originate partly from books on laser therapy<sup>(9, 10, 11)</sup> and from own practical experiences and practical experiences of partners.

The practitioner is the person who determines the settings and dosage to use when treating each individual patient/animal.

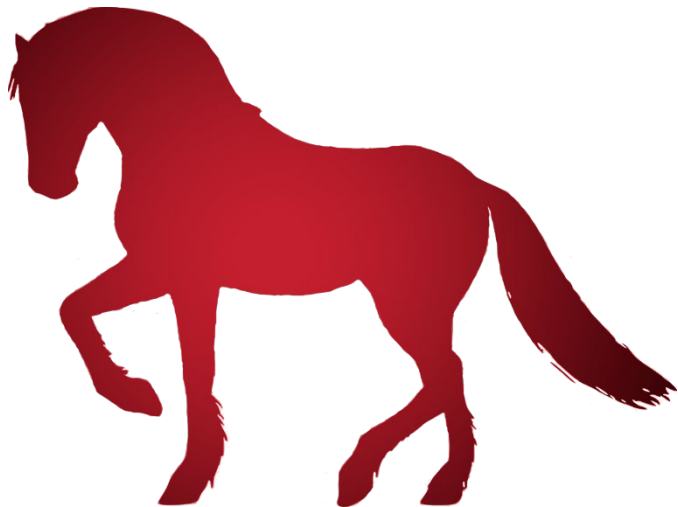
## Equine Dosage Guidelines





## General Equine Dosage Guidelines

Therapy Guideline:



Diagnosis	Laser type	Dosage J/cm <sup>2</sup>	Time (min:sec)/cm <sup>2</sup>		Technique	Frequency
Superficial Structures	IR	6-18 J/cm <sup>2</sup>	500 mW	0:12-0:36	Scanning or Point	Individual - Depends on the phase and condition of the injury
	L400 L500 L2000		400 mW	0:15-0:45		
			200 mW	0:30-1:30		
Deep Musculature	IR	15-35 J/cm <sup>2</sup>	500 mW	0:30-1:10	Scanning or Point	Individual - Depends on the phase and condition of the injury
	L400 L500 L2000		400 mW	0:38-1:28		
			200 mW	1:15-2:55		
Small Joints	IR	15-25 J/cm <sup>2</sup>	500 mW	0:30-0:50	Scanning or Point	Individual - Depends on the phase and condition of the injury
	L400 L500 L2000		400 mW	0:38-1:03		
			200 mW	1:15-2:05		
Large Joints	IR	20-40 J/cm <sup>2</sup>	500 mW	0:40-1:20	Scanning or Point	Individual - Depends on the phase and condition of the injury
	L400 L500 L2000		400 mW	0:50-1:40		
			200 mW	1:40-3:20		

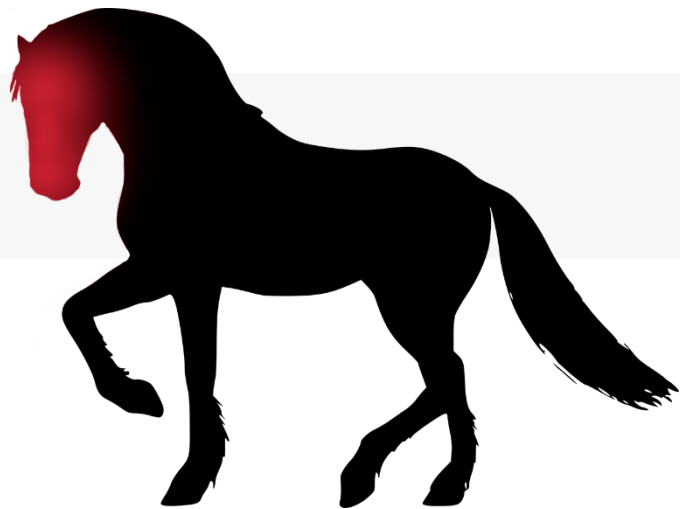
Trigger Points	IR	2-8 J/cm <sup>2</sup>	500 mW	0:04- 0:16	Point	Individual - Depends on the phase and condition of the injury
	L400 L500 L2000		400 mW	0:05- 0:20		
			200 mW	0:10- 0:40		
Acupuncture Points	IR	5-10 J/cm <sup>2</sup>	500 mW	0:10- 0:20	Point	Individual - Depends on the phase and condition of the injury
	L400 L500 L2000		400 mW	0:13- 0:25		
			200 mW	0:25- 0:50		

## Specific Equine Dosage Guidelines

### Head

Therapy Guideline:

## Head

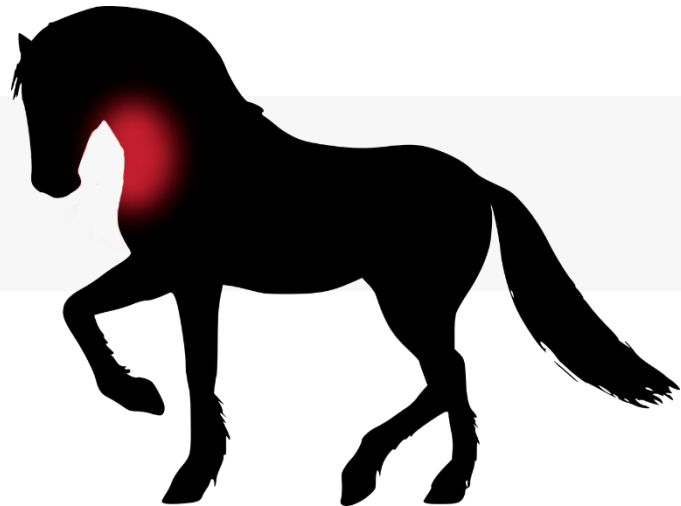


Diagnosis	Laser type	Dosage J/cm <sup>2</sup>	Time (min:sec)/cm <sup>2</sup>		Technique	Frequency
Toothache and Inflammation	IR	2-6 J/cm <sup>2</sup>	500 mW	0:04-0:12	Scanning or Point	Acute: Daily
	L400 L500 L2000		400 mW	0:05-0:15		Chronic: 2-3 times/week
			200 mW	0:10-0:30		
Sinusitis	IR	15-20 J/cm <sup>2</sup>	500 mW	0:30-0:40	Scanning or Point	Three or four sessions daily. Then every other day until condition is solved
	L400 L500 L2000		400 mW	0:38-0:50		
			200 mW	1:15-1:40		
Dental Extraction	IR	2-4 J/cm <sup>2</sup>	500 mW	0:04-0:08	Scanning or Point	Acute: Daily
	L400 L500 L2000		400 mW	0:05-0:10		Chronic: 2-3 times/week
			200 mW	0:10-0:20		

Temporomandibular Joint Syndrome	IR	8-12 J/cm <sup>2</sup>	500 mW	0:16- 0:24	Scanning or Point	Acute: Daily
	L400 L500 L2000		400 mW	0:20- 0:30		Chronic: 2-3 times/week
			200 mW	0:40- 1:00		
Lacerations (Superficial Wounds)	IR/RED	2-3 J/cm <sup>2</sup>	500 mW	0:04- 0:06	Scanning or Point	Acute: Daily
	L400 L500 L2000		400 mW	0:05- 0:08		Chronic: 2-3 times/week
			200 mW	0:10- 0:15		
	L200 L800		100 mW	0:20- 0:30		
			50 mW	0:40- 1:00		

*Throat*

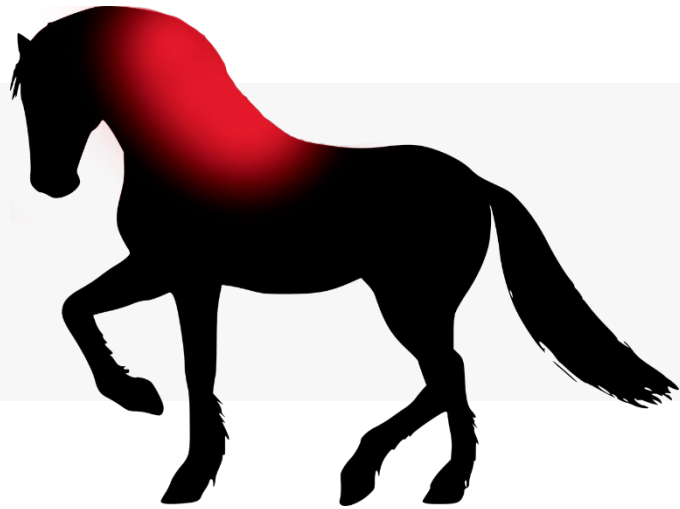
Therapy Guideline:

**Throat**

Diagnosis	Laser type	Dosage J/cm <sup>2</sup>	Time (min:sec)/cm <sup>2</sup>		Technique	Frequency
Pharyngeal Lymphoid Hyperplasia	IR	15-20 J/cm <sup>2</sup>	500 mW	0:30-0:40	Scanning or Point	Acute: Daily
	L400 L500 L2000		400 mW	0:38-0:50		Chronic: 2-3 times/week
			200 mW	1:15-1:40		
Postoperative Incision	IR/RED	4-8 J/cm <sup>2</sup>	500 mW	0:08-0:16	Scanning or Point	Acute: Daily
	L400 L500 L2000		400 mW	0:10-0:20		Chronic: 2-3 times/week
			200 mW	0:20-0:40		
	L200 L800		100 mW	0:40-1:20		
			50 mW	1:20-2:40		

*Cervical Spine and Neck*

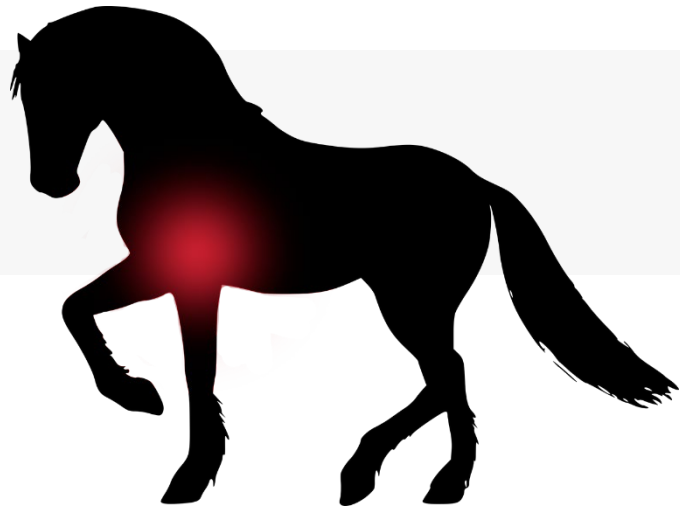
Therapy Guideline:

**Cervical Spine  
and Neck**

Diagnosis	Laser type	Dosage J/cm <sup>2</sup>	Time (min:sec)/cm <sup>2</sup>		Technique	Frequency
Myositis and Muscle Soreness	IR	8-20 J/cm <sup>2</sup>	500 mW	0:16-0:40	Scanning or Point	Acute: Daily
	L400 L500 L2000		400 mW	0:20-0:50		Chronic: 2-3 times/week
			200 mW	0:40-1:40		
Prior to Cervical Joint Adjustment (Easier Adjustment)	IR	3-5 J/cm <sup>2</sup>	500 mW	0:06-0:10	Scanning or Point	Three or four sessions daily. Then every other day until condition is solved
	L400 L500 L2000		400 mW	0:08-0:13		
			200 mW	0:15-0:25		
Post to Cervical Joint Adjustment (Relief of Pain and Inflammation)	IR	10-15 J/cm <sup>2</sup>	500 mW	0:20-0:30	Scanning or Point	Acute: Daily
	L400 L500 L2000		400 mW	0:25-0:38		Chronic: 2-3 times/week
			200 mW	0:50-1:15		

*Shoulder*

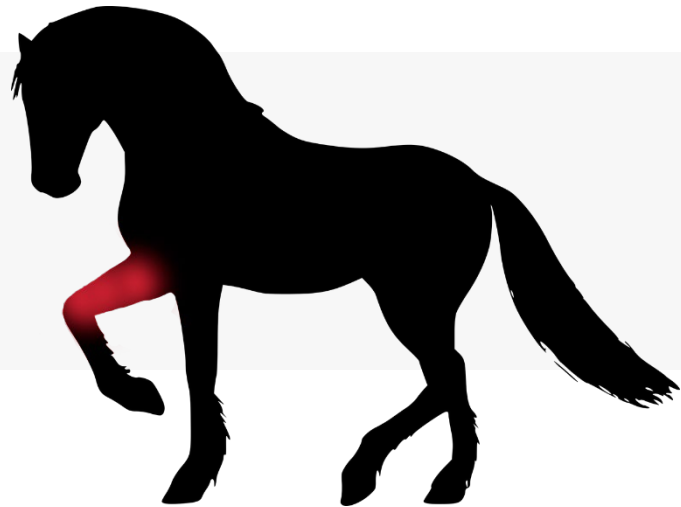
Therapy Guideline:

**Shoulder**

Diagnosis	Laser type	Dosage J/cm <sup>2</sup>	Time (min:sec)/cm <sup>2</sup>		Technique	Frequency
Bicipital Bursitis	IR	8-10 J/cm <sup>2</sup>	500 mW	0:16-0:20	Scanning or Point	Acute: Daily
	L400 L500 L2000		400 mW	0:20-0:25		Chronic: 3-4 times/week
			200 mW	0:40-0:50		
Scapula Fracture	IR	10-15 J/cm <sup>2</sup>	500 mW	0:20-0:30	Scanning or Point	Acute: Daily
	L400 L500 L2000		400 mW	0:25-0:38		Chronic: 3-4 times/week
			200 mW	0:50-1:15		
Muscle Inflammation (Shoulder Girdle)	IR	10-20 J/cm <sup>2</sup>	500 mW	0:20-0:40	Scanning or Point	Acute: Daily
	L400 L500 L2000		400 mW	0:25-0:50		Chronic: 3-4 times/week
			200 mW	0:50-1:40		

*Upper Arm and Forearm*

Therapy Guideline:

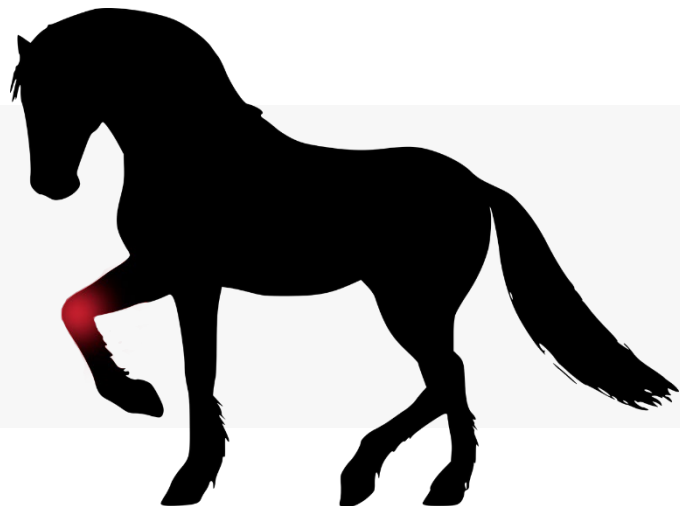
**Upper Arm and Forearm**

Diagnosis	Laser type	Dosage J/cm <sup>2</sup>	Time (min:sec)/cm <sup>2</sup>		Technique	Frequency
Conservatively Treated Fractures	IR	12-20 J/cm <sup>2</sup>	500 mW	0:24-0:40	Scanning or Point	Acute: Daily
	L400 L500 L2000		400 mW	0:30-0:50		Chronic: 3-4 times/week
			200 mW	1:00-1:40		
Nerve Tissue (Radial Nerve)	IR	25-30 J/cm <sup>2</sup>	500 mW	0:50-1:00	Scanning or Point	Acute: Daily
	L400 L500 L2000		400 mW	1:03-1:15		Chronic: 3-4 times/week
			200 mW	2:05-2:30		
Radial Head of Superficial Digital Flexor Tendon	IR	10-15 J/cm <sup>2</sup>	500 mW	0:20-0:30	Scanning or Point	Two treatments daily. Then less frequent until condition is solved
	L400 L500 L2000		400 mW	0:25-0:38		
			200 mW	0:50-1:15		



*Carpus and Metacarpus*

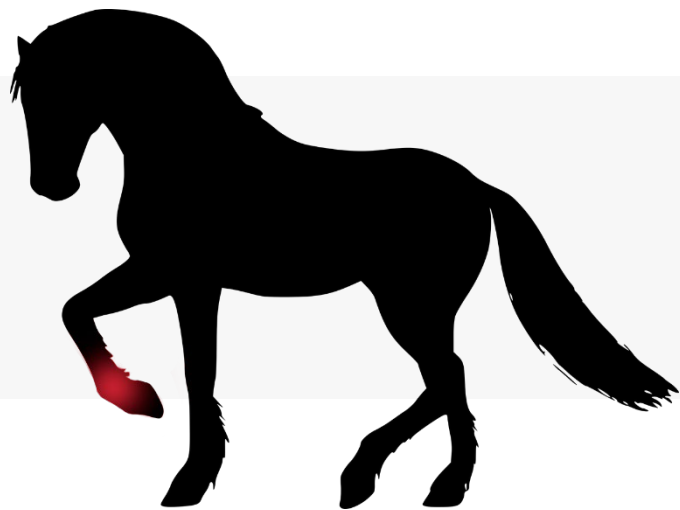
Therapy Guideline:

**Carpus and  
Metacarpus**

Diagnosis	Laser type	Dosage J/cm <sup>2</sup>	Time (min:sec)/cm <sup>2</sup>		Technique	Frequency
Degenerative Joint Disease	IR	20-30 J/cm <sup>2</sup>	500 mW	0:40-1:00	Scanning or Point	Acute: Daily
Carpitis and Synovitis	L400		400 mW	0:50-1:15		Chronic: 2-3 times/week
Hygroma of the Carpus	L500		200 mW	1:40-2:30		
Carpal Tunnel Syndrome	L2000					
Osteoarthritis						
Carpal Pain						
Stress Fracture of Metacarpal Bone	IR	10-12 J/cm <sup>2</sup>	500 mW	0:20-0:24	Scanning or Point	Acute: Daily
	L400		400 mW	0:25-0:30		Chronic: 2-3 times/week
	L500		200 mW	0:50-1:00		
	L2000					
Suspensory Desmitis	IR	12-20 J/cm <sup>2</sup>	500 mW	0:24-0:40	Scanning or Point	Acute: Daily
	L400		400 mW	0:50-0:10		Chronic: 2-3 times/week
	L500		200 mW	1:00-1:40		
	L2000					

*Fetlock and Pastern*

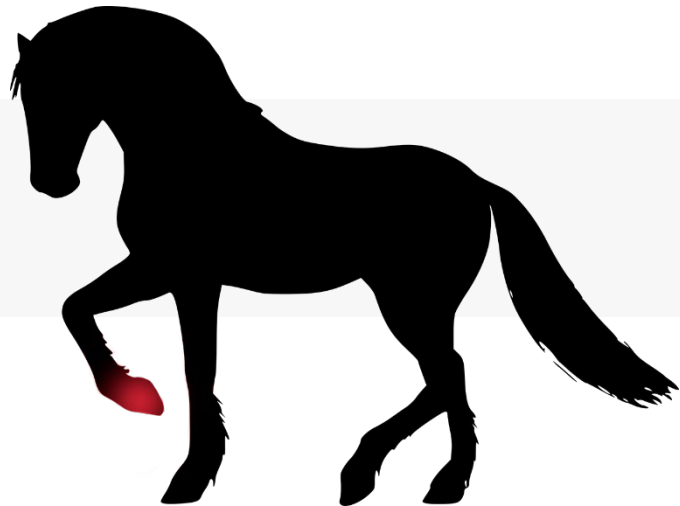
Therapy Guideline:

**Fetlock and  
Pastern**

Diagnosis	Laser type	Dosage J/cm <sup>2</sup>	Time (min:sec)/cm <sup>2</sup>		Technique	Frequency
Sesamoiditis	IR	8-12 J/cm <sup>2</sup>	500 mW	0:16-0:24	Scanning or Point	Acute: Daily
Fractures of the Sesamoid Bones	L400 L500 L2000		400 mW	0:20-0:30		Chronic: 2-3 times/week
Chronic Proliferative Synovitis			200 mW	0:40-1:00		
Osslets						
Ringbone Osteochondrosis						
Palmar Annular Ligament Constriction						

*Hoof*

Therapy Guideline:

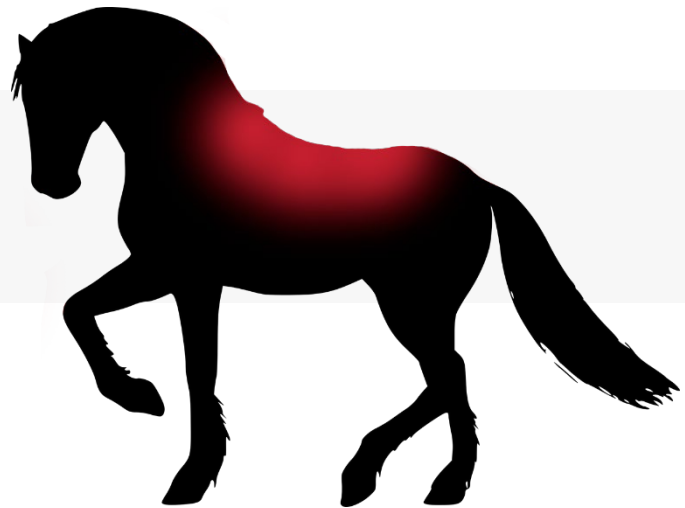
**Hoof**

Diagnosis	Laser type	Dosage J/cm <sup>2</sup>	Time (min:sec)/cm <sup>2</sup>		Technique	Frequency
Hoof pain <ul style="list-style-type: none"> <li>- Coffin Joint</li> <li>- Navicular Bone and Bursa</li> <li>- "T" Ligament</li> <li>- Medial and Lateral Collateral Ligaments</li> <li>- Lateral and Medial Ligaments</li> <li>- Lateral Cartilage</li> <li>- Deep Digital Flexor Tendon</li> <li>- Superficial Digital Flexor Tendon</li> <li>- Digital Extensor Tendon</li> </ul>	IR	8-10 J/cm <sup>2</sup>	500 mW	0:16-0:20	Scanning or Point	Acute: Daily
	L400 L500 L2000		400 mW	0:20-0:25		Chronic: 2-3 times/week
			200 mW	0:40-0:50		
Laminitis	IR	4-6 J/cm <sup>2</sup>	500 mW	0:08-0:12	Scanning or Point	Acute: Two times/day
	L400 L500 L2000		400 mW	0:10-0:15		Chronic: 2-3 times/week
			200 mW	0:20-0:30		

Palmar foot pain (pain and inflammation)	IR	6-8 J/cm <sup>2</sup>	500 mW	0:12-0:16	Scanning or Point	Acute: Daily  Chronic: 2-3 times/week
	L400 L500 L2000		400 mW	0:15-0:20		
			200 mW	0:30-0:40		
Podotrochleosis	IR	10-15 J/cm <sup>2</sup>	500 mW	0:20-0:30	Scanning or Point	Acute: Daily  Chronic: 2-3 times/week
	L400 L500 L2000		400 mW	0:25-0:38		
			200 mW	0:50-1:15		
Lacerations (superficial wounds)	IR/RED	2-3 J/cm <sup>2</sup>	500 mW	0:04-0:06	Scanning or Point	Acute: Daily  Chronic: 2-3 times/week
	L400 L500 L2000		400 mW	0:05-0:08		
			200 mW	0:10-0:15		
	L200 L800		100 mW	0:20-0:30		
			50 mW	0:40-1:00		

*Back*

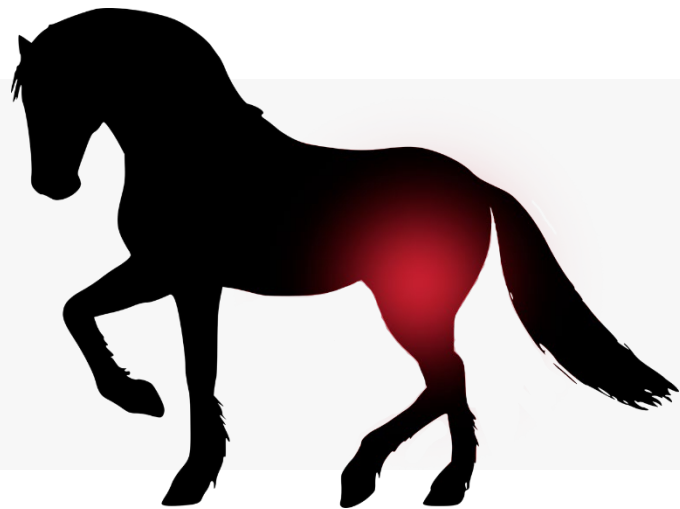
Therapy Guideline:

**Back**

Diagnosis	Laser type	Dosage J/cm <sup>2</sup>	Time (min:sec)/cm <sup>2</sup>		Technique	Frequency
Back Pain	IR	25-40 J/cm <sup>2</sup>	500 mW	0:50-1:20	Scanning or Point	Acute: Daily
	L400 L500 L2000		400 mW	1:03-1:40		Chronic: 2-3 times/week
			200 mW	2:05-3:20		

*Hip, Pelvis and Upper Hind Limb*

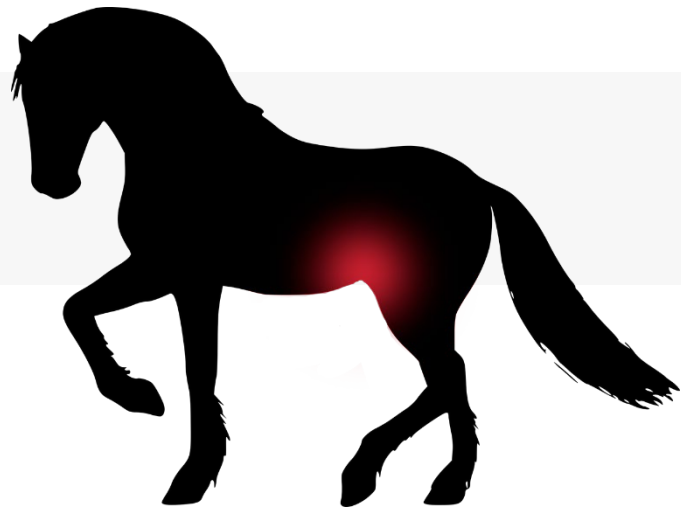
Area Therapy Guideline:

**Hip, Pelvis and  
Upper Hind Limb**

Diagnosis	Laser type	Dosage J/cm <sup>2</sup>	Time (min:sec)/cm <sup>2</sup>		Technique	Frequency
Myositis <ul style="list-style-type: none"> <li>- Semimembranosus and Semitendinosus</li> <li>- Biceps femoris</li> <li>- Gluteal</li> <li>- Quadratus lumborum</li> <li>- Iliacus</li> <li>- Psoas Major and Minor</li> </ul>	IR	20-40 J/cm <sup>2</sup>	500 mW	0:40-1:20	Scanning or Point	Acute: Daily
	L400		400 mW	0:50-1:40		Chronic: 2-3 times/week
	L500		200 mW	1:40-3:20		
	L2000					
Trochanteric Bursitis	IR	35-40 J/cm <sup>2</sup>	500 mW	1:10-1:20	Scanning or Point	Acute: Daily
	L400		400 mW	1:28-1:40		Chronic: 2-3 times/week
	L500 L2000		200 mW	2:55-3:20		

*Stifle*

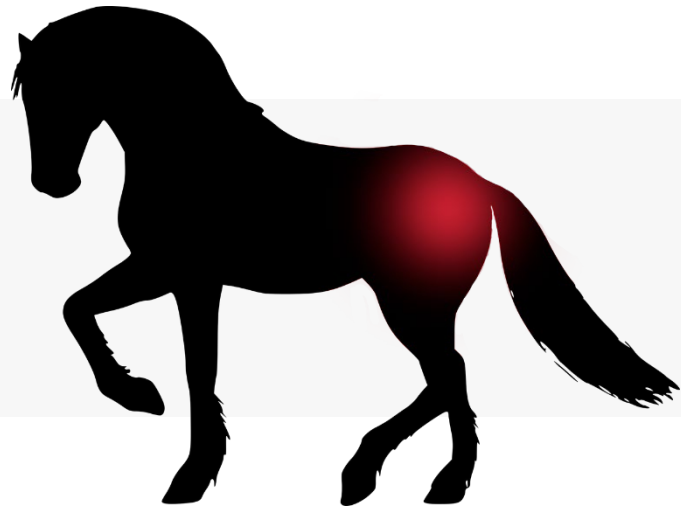
Area Therapy Guideline:

**Stifle**

Diagnosis	Laser type	Dosage J/cm <sup>2</sup>	Time (min:sec)/cm <sup>2</sup>		Technique	Frequency
Medial Patellar Ligament Pain and Inflammation	IR	20-25 J/cm <sup>2</sup>	500 mW	0:40-0:50	Scanning or Point	Acute: Daily
	L400 L500 L2000		400 mW	0:50-1:03		Chronic: 2-3 times/week
			200 mW	1:40-2:05		
Ligamentous Strains and Sprains	IR	20-30 J/cm <sup>2</sup>	500 mW	0:40-1:00	Scanning or Point	Acute: Daily
	L400 L500 L2000		400 mW	0:50-1:15		Chronic: 2-3 times/week
			200 mW	1:40-2:30		
Capsulitis	IR	20-40 J/cm <sup>2</sup>	500 mW	0:40-1:20	Scanning or Point	Acute: Daily
Synovitis	L400 L500 L2000		400 mW	0:50-1:40		Chronic: 2-3 times/week
Osteochondritis Dessicans			200 mW	1:40-3:20		
Subchondral Bone Cyst						
Osteoarthritis						

*Tarsus and Metatarsus*

Area Therapy Guideline:

**Tarsus and  
Metatarsus**

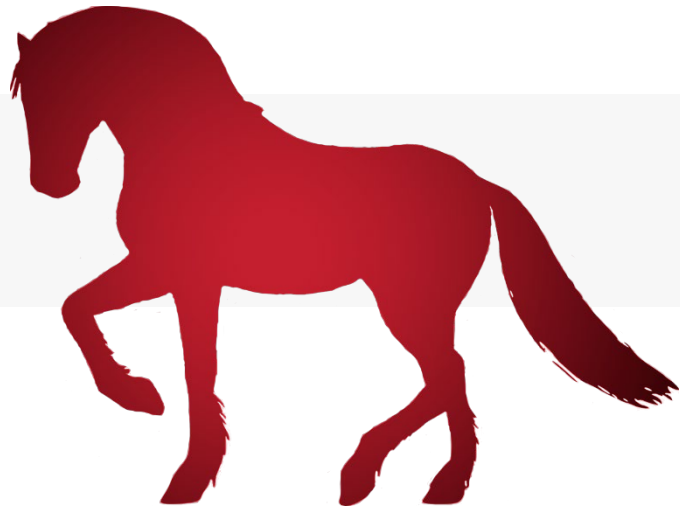
Diagnosis	Laser type	Dosage J/cm²	Time (min:sec)/cm²		Technique	Frequency
Synovitis	IR	20-25 J/cm²	500 mW	0:40-0:50	Scanning or Point	Acute: Daily Chronic: 2-3 times/week
Joint Capsulitis	L400 L500		400 mW	0:50-1:03		
Cunean Bursitis	L2000		200 mW	1:40-2:05		
Cunean Tendinitis						
Fractures						
Osteoarthritis						
Osteitis						
Tarsocrural Synovitis						
Tarsal Plantar Desmitis						
Osteochondrosis	IR	25-30 J/cm²	500 mW	0:50-1:00	Scanning or Point	As often as possible with at least 12 treatments over 30 days
	L400 L500		400 mW	1:03-1:15		
	L2000		200 mW	2:05-2:30		



Tendonitis and Desmitis (Inflammation)	IR	15-20 J/cm <sup>2</sup>	500 mW	0:30- 0:40	Scanning or Point	Acute: Daily Chronic: 2-3 times/week
	L400 L500 L2000		400 mW	0:38- 0:50		
			200 mW	1:15- 1:40		
Synovial Membrane and Joint Capsule (Inflammation)	IR	10-15 J/cm <sup>2</sup>	500 mW	0:20- 0:30	Scanning or Point	Acute: Daily Chronic: 2-3 times/week
	L400 L500 L2000		400 mW	0:25- 0:38		
			200 mW	0:50- 1:15		

*Wounds*

Area Therapy Guideline:

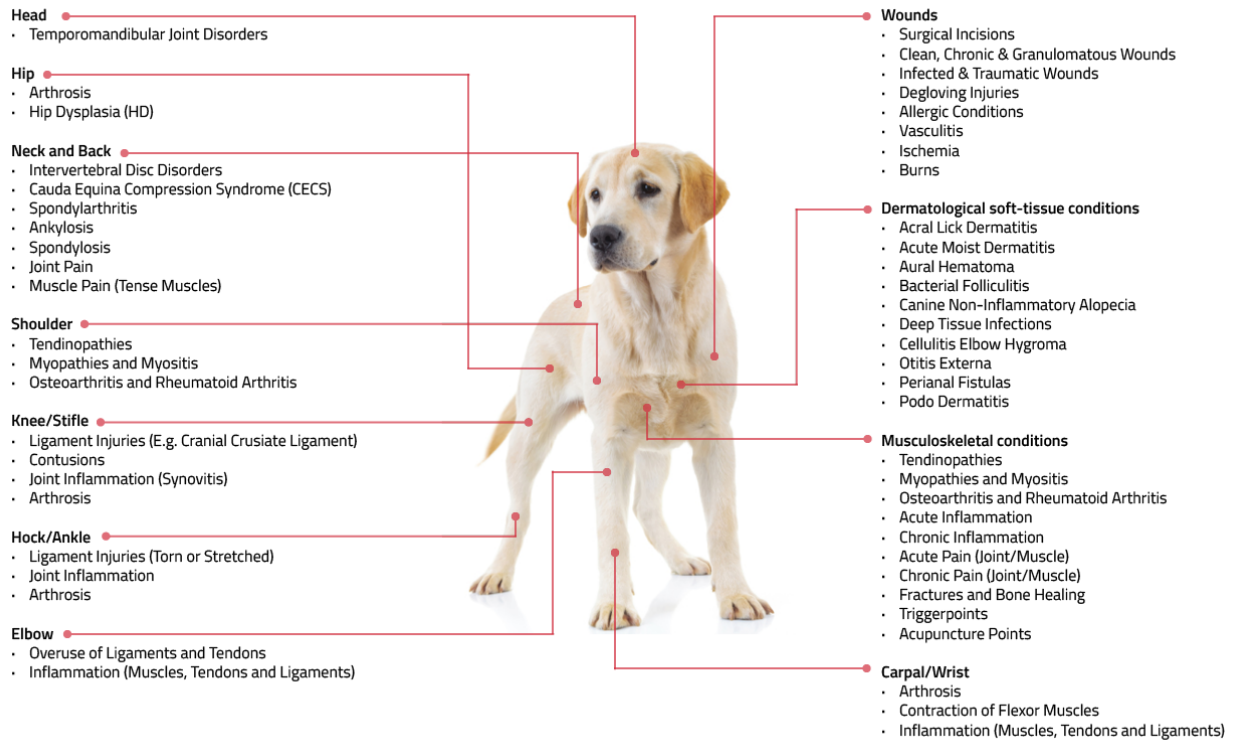
**Wounds**

Diagnosis	Laser type	Dosage J/cm <sup>2</sup>	Time (min:sec)/cm <sup>2</sup>		Technique	Frequency
Abrasion	RED	2-6 J/cm <sup>2</sup>	200 mW	0:10-0:30	Scanning or Point (contact/non-contact)	Daily until resolved
	L200		100 mW	0:20-1:00		
	L800		50 mW	0:40-2:00		
Wheal	RED	2-4 J/cm <sup>2</sup>	200 mW	0:10-0:20	Scanning or Point (contact/non-contact)	Daily until resolved
	L200		100 mW	0:20-0:40		
	L800		50 mW	0:40-1:20		
Contusion	RED	4-8 J/cm <sup>2</sup>	200 mW	0:20-0:40	Scanning or Point (contact/non-contact)	Daily until resolved
	L200		100 mW	0:40-1:20		
	L800		50 mW	1:20-2:40		

Incisional	RED	4-6 J/cm <sup>2</sup>	200 mW	0:20- 0:30	Scanning or Point (contact/non- contact)	Daily until resolved
	L200 L800		100 mW	0:40- 1:00		
			50 mW	1:20- 2:00		
Laceration (Sutured)	RED	4-6 J/cm <sup>2</sup>	200 mW	0:20- 0:30	Scanning or Point (contact/non- contact)	Daily until resolved
	L200 L800		100 mW	0:40- 1:00		
			50 mW	1:20- 2:00		
Laceration Open	RED	8-12 J/cm <sup>2</sup>	200 mW	0:40- 1:00	Scanning or Point (contact/non- contact)	Daily until resolved
	L200 L800		100 mW	1:20- 2:00		
			50 mW	2:40- 4:00		
Laceration (Muscle, Tendon and Hoof Involvement)	RED	10-12 J/cm <sup>2</sup>	200 mW	0:50- 1:00	Scanning or Point (contact/non- contact)	Daily until resolved
	L200 L800		100 mW	1:40- 2:00		
			50 mW	3:20- 4:00		
Puncture Non-Infected Minor Muscle Damage	RED	6-8 J/cm <sup>2</sup>	200 mW	0:30- 0:40	Scanning or Point (contact/non- contact)	Daily until resolved
	L200 L800		100 mW	1:00- 1:20		
			50 mW	2:00- 2:40		
Puncture Not Infected Muscle/Tendon Damage	RED	8-12 J/cm <sup>2</sup>	200 mW	0:40- 1:00	Scanning or Point (contact/non- contact)	Daily until resolved
	L200 L800		100 mW	1:20- 2:00		
			50 mW	2:40- 4:00		

Puncture Infected	RED	10-12 J/cm <sup>2</sup>	200 mW	0:50- 1:00	Scanning or Point (contact/non- contact)	Daily until resolved
	L200 L800		100 mW	1:40- 2:00		
			50 mW	3:20- 4:00		
Chronic	RED	10-12 J/cm <sup>2</sup>	200 mW	0:50- 1:00	Scanning or Point (contact/non- contact)	Daily until resolved
	L200 L800		100 mW	1:40- 2:00		
			50 mW	3:20- 4:00		
Chronic (Profuse Granulation)	RED	10-15 J/cm <sup>2</sup>	200 mW	0:50- 1:15	Scanning or Point (contact/non- contact)	Daily until resolved
	L200 L800		100 mW	1:40- 2:30		
			50 mW	3:20- 5:00		

# Canine Dosage Guidelines

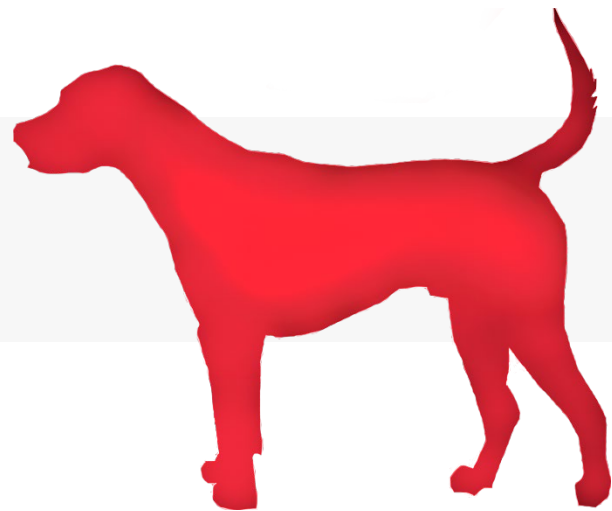


## Specific Canine Dosage Guidelines

### Wounds

Area Therapy Guideline:

## Wounds

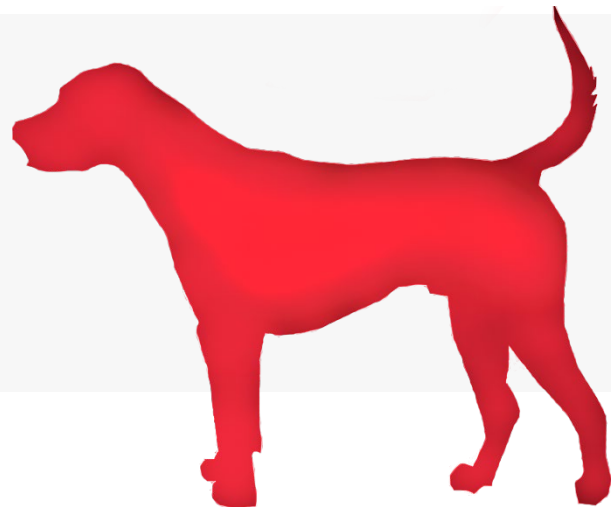


Diagnosis	Laser type	Dosage J/cm <sup>2</sup>	Time (min:sec)/cm <sup>2</sup>		Technique	Frequency
Surgical Incisions	RED	2-4 J/cm <sup>2</sup>	200 mW	0:10-0:20	Scanning or Point	Daily for 2-3 days and then every other day
Clean Wounds	L200 L800		100 mW	0:20-0:40		
			50 mW	0:40-1:20		
Chronic Wounds	RED	4-6 J/cm <sup>2</sup>	200 mW	0:20-0:30	Scanning or Point	Daily for 2-5 days and then every other day
Granulomatous Wounds	L200 L800		100 mW	0:40-1:00		
Infected Wounds			50 mW	1:20-2:00		
Traumatic Wounds	RED	4-6 J/cm <sup>2</sup>	200 mW	0:20-0:30	Scanning or Point	Daily for 2-3 days and then every other day
	L200 L800		100 mW	0:40-1:00		
			50 mW	1:20-2:00		
Degloving Injuries	RED	4-6 J/cm <sup>2</sup>	200 mW	0:20-0:30	Scanning or Point	
	L200 L800		100 mW	0:40-1:00		
			50 mW	1:20-2:00		

Autoimmune Conditions  Allergic Conditions	RED	8-12 J/cm <sup>2</sup>	200 mW	0:40- 1:00	Scanning or Point	Daily until response and then prophylactic treatment
	L200		100 mW	1:20- 2:00		
	L800		50 mW	2:40- 4:00		
Vasculitis  Ischemia	RED	4-6 J/cm <sup>2</sup>	200 mW	0:20- 0:30	Scanning or Point	Daily for 2-3 days and then every other day
	L200		100 mW	0:40- 1:00		
	L800		50 mW	1:20- 2:00		
Burns	RED	2-3 J/cm <sup>2</sup>	200 mW	0:10- 0:15	Scanning or Point	Daily for 2-3 days and then every other day
	L200		100 mW	0:20- 0:30		
	L800		50 mW	0:40- 1:00		

*Dermatological Soft-Tissue Conditions*

Area Therapy Guideline:

**Dermatological  
Soft-Tissue  
Conditions**

Diagnosis	Laser type	Dosage J/cm <sup>2</sup>	Time (min:sec)/cm <sup>2</sup>		Technique	Frequency
Acral Lick Dermatitis	RED	30-40 J/cm <sup>2</sup>	200 mW	2:30-3:20	Scanning or Point	2-3 sessions/week. When clinical response is reached frequency is reduced
	L200		100 mW	5:00-6:40		
	L800		50 mW	10:00-13:20		
Acute Moist Dermatitis	RED	3-4 J/cm <sup>2</sup>	200 mW	0:15-0:20	Scanning or Point (non-contact)	Daily until solution is reached
Hot Spots	L200		100 mW	0:30-0:40		
Pyotraumatic Dermatitis	L800		50 mW	1:00-1:20		
Anal Sacculitis	RED	6-8 J/cm <sup>2</sup>	200 mW	0:30-0:40	Scanning or Point (contact/non-contact)	Acute: Daily  Chronic: 2-3 times/week. When clinical response is reached frequency is reduced
	L200		100 mW	1:00-1:20		
	L800		50 mW	2:00-2:40		



Anal Sac Abscess	RED	8-10 J/cm <sup>2</sup>	200 mW	0:40-0:50	Scanning or Point	Daily for 2-3 days. Then every other day until the cellulitis and fitulous tracts have healed
	L200		100 mW	1:20-1:40		
	L800		50 mW	2:40-3:20		
Aural Hematoma	RED	3-6 J/cm <sup>2</sup>	200 mW	0:15-0:30	Scanning or Point	Daily until response. Then prophylactic treatment
	L200		100 mW	0:30-1:00		
	L800		50 mW	1:00-2:00		
Bacterial Folliculitis	RED	3-4 J/cm <sup>2</sup>	200 mW	0:15-0:20	Scanning or Point (non-contact)	Daily for 3-5 days. Then twice a week until solved
	L200		100 mW	0:30-0:40		
	L800		50 mW	1:00-1:20		
Canine Non-Inflammatory Alopecia	RED	2-3 J/cm <sup>2</sup>	200 mW	0:10-0:15	Scanning or Point	Twice weekly until hair growth is observed
	L200		100 mW	0:20-1:00		
	L800		50 mW	0:40-2:00		
Deep Tissue Infections  Abscesses  Cellulitis	RED	3-10 J/cm <sup>2</sup>  (Superficial: 3-5 J/cm <sup>2</sup> ; Subcutaneous: 6-8 J/cm <sup>2</sup> ; Deep tissue: 8-10 J/cm <sup>2</sup> )	200 mW	0:15-0:50	Scanning or Point (non-contact)	Daily for 2-3 days. Then every other day until the infection is solved
	L200		100 mW	1:00-1:40		
	L800		50 mW	2:00-3:20		
Elbow Hygroma	RED	30-40 J/cm <sup>2</sup>	200 mW	2:30-3:20	Scanning or Point	2-3 times/week. When clinical response is reached frequency is reduced
	L200		100 mW	5:00-6:40		
	L800		50 mW	10:00-13:20		

Otitis Externa	RED	3-20 J/cm <sup>2</sup>	200 mW	0:15-1:40	Scanning or Point	Daily until solved
	L200 L800	(Superficial: 3-4 J/cm <sup>2</sup> ; Deep: 6-8 J/cm <sup>2</sup> ; Deep with severe hyperplasia: 10-20 J/cm <sup>2</sup> )	100 mW	1:00-3:20		
			50 mW	2:00-6:40		
Perianal Fistulas	RED	12-15 J/cm <sup>2</sup>	200 mW	1:00-1:15	Scanning or Point (non-contact)	2-3 times/week. When clinical response is noted frequency is reduced
	L200 L800		100 mW	2:00-2:30		
			50 mW	4:00-5:00		
Podo Dermatitis	RED	6-8 J/cm <sup>2</sup>	200 mW	0:30-0:40	Scanning or Point (non-contact)	2-3 times/week. When clinical response is noted frequency is reduced
	L200 L800		100 mW	1:00-1:20		
			50 mW	2:00-2:40		

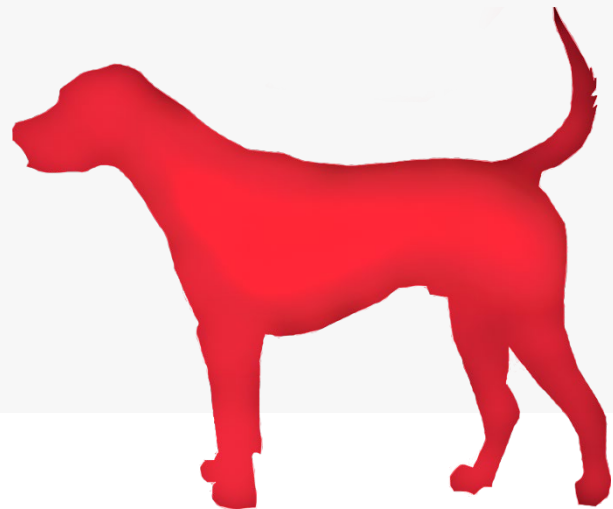
*Musculoskeletal Conditions*

Area Therapy Guideline:

# General

## Musculoskeletal

### Dosage Guidelines

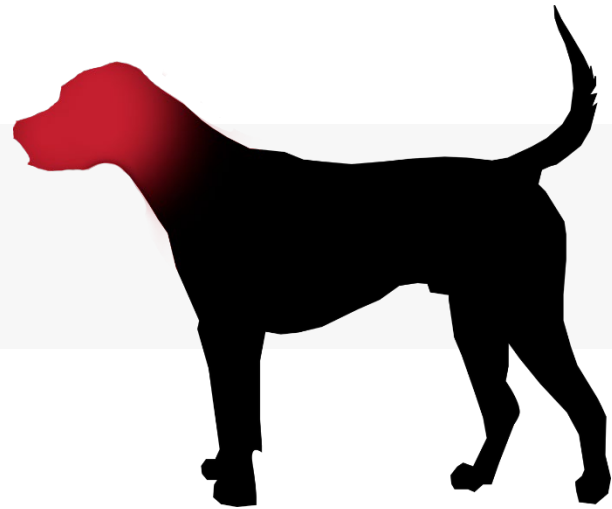


Diagnosis	Laser type	Dosage J/cm <sup>2</sup>	Time (min:sec)/cm <sup>2</sup>		Technique	Frequency
Tendinopathies	IR	4-10 J/cm <sup>2</sup>	500 mW	0:08-0:20	Scanning or Point	Acute: Daily until improved clinical response. Then twice a week and then once a week in a "transition phase" until condition is resolved.  Chronic: Daily for 3 days and then twice or three times a week until clinical effect is noted.  A "maintenance phase" is established for conditions without permanent cure. E.g. laser therapy once every 2-4 weeks based on patient response.
Myopathies and Myositis	L400 L500 L2000		400 mW	0:10-0:25		
Osteoarthritis and Rheumatoid Arthritis			200 mW	0:20-0:50		
Acute Inflammation	IR  L400 L500 L2000	2-4 J/cm <sup>2</sup>	500 mW	0:04-0:08	Scanning or Point	"
			400 mW	0:05-0:10		
			200 mW	0:10-0:20		

Chronic Inflammation	IR	4-6 J/cm <sup>2</sup>	500 mW	0:08-0:12	Scanning or Point	"
	L400 L500 L2000		400 mW	0:10-0:15		
			200 mW	0:20-0:30		
Acute Pain (Joint/Muscle)	IR	4-6 J/cm <sup>2</sup>	500 mW	0:08-0:12	Scanning or Point	"
	L400 L500 L2000		400 mW	0:10-0:15		
			200 mW	0:20-0:30		
Chronic Pain (Joint/Muscle)	IR	4-8 J/cm <sup>2</sup>	500 mW	0:08-0:16	Scanning or Point	"
	L400 L500 L2000		400 mW	0:10-0:20		
			200 mW	0:20-0:40		
Fractures and Bone Healing	IR	8-10 J/cm <sup>2</sup>	500 mW	0:16-0:20	Scanning or Point	"
	L400 L500 L2000		400 mW	0:20-0:25		
			200 mW	0:40-0:50		
Triggerpoints	IR	2-6 J/cm <sup>2</sup>	500 mW	0:04-0:12	Point	"
	L400 L500 L2000		400 mW	0:05-0:15		
			200 mW	0:10-0:30		
Acupuncture Points	IR	1-5 J/cm <sup>2</sup>	500 mW	0:02-0:10	Point	"
	L400 L500 L2000		400 mW	0:03-0:13		
			200 mW	0:05-0:25		

*Head*

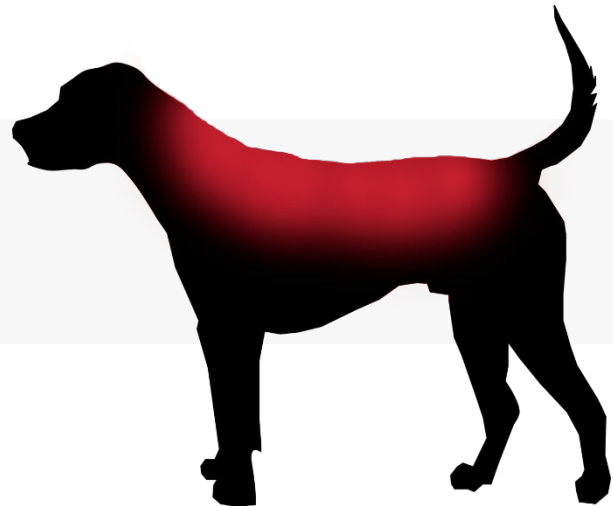
Area Therapy Guideline:

**Head**

Diagnosis	Laser type	Dosage J/cm <sup>2</sup>	Time (min:sec)/cm <sup>2</sup>		Technique	Frequency
Temporomandibular Joint Disorders	IR	4-10 J/cm <sup>2</sup>	500 mW	0:08-0:20	Scanning or Point	<p>Acute: Daily until improved clinical response. Then twice a week and then once a week in a "transition phase" until condition is resolved.</p> <p>Chronic: Daily for 3 days and then twice or three times a week until clinical effect is noted.</p> <p>A "maintenance phase" is established for conditions without permanent cure.</p> <p>E.g. laser therapy once every 2-4 weeks based on patient response.</p>
	L400 L500 L2000		400 mW	0:10-0:25		
			200 mW	0:20-0:50		

*Neck and Back*

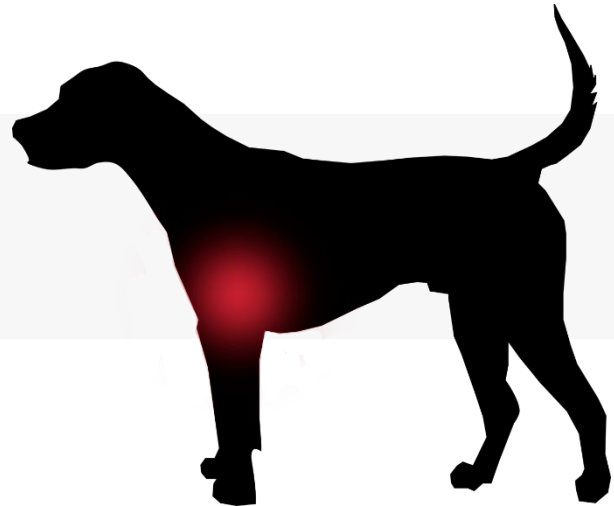
Area Therapy Guideline:

**Neck and Back**

Diagnosis	Laser type	Dosage J/cm <sup>2</sup>	Time (min:sec)/cm <sup>2</sup>		Technique	Frequency
Intervertebral Disc Disorders	IR	4-12 J/cm <sup>2</sup>	500 mW	0:08-0:24	Scanning or Point	Acute: Daily until improved clinical response. Then twice a week and then once a week in a "transition phase" until condition is resolved.
Cauda Equina Compression Syndrome (CECS)	L400		400 mW	0:10-0:30		
Spondylarthritis	L500		200 mW	0:20-1:00		
Ankylosis	L2000					Chronic: Daily for 3 days and then twice or three times a week until clinical effect is noted.
Spondylosis						A "maintenance phase" is established for conditions without permanent cure. E.g. laser therapy once every 2-4 weeks based on patient response.
Joint Pain						
Muscle Pain (Tense Muscles)						

## Shoulder

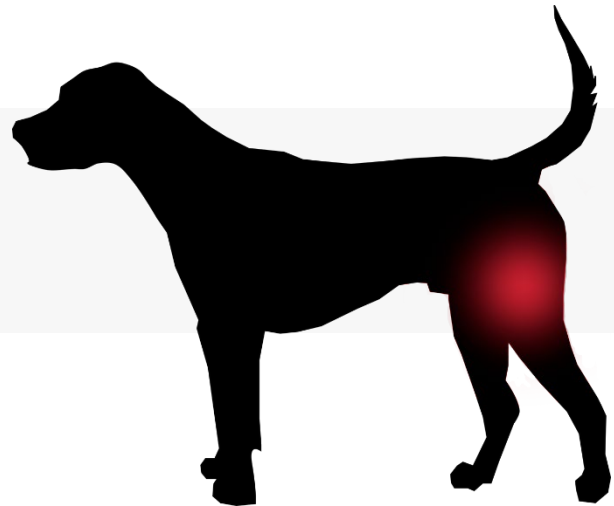
Area Therapy Guideline:

**Shoulder**

Diagnosis	Laser type	Dosage J/cm <sup>2</sup>	Time (min:sec)/cm <sup>2</sup>		Technique	Frequency
Tendinopathies	IR	4-8 J/cm <sup>2</sup>	500 mW	0:08-0:16	Scanning or Point	Acute: Daily until improved clinical response. Then twice a week and then once a week in a "transition phase" until condition is resolved.
Myopathies and Myositis	L400 L500 L2000		400 mW	0:10-0:20		
Osteoarthritis and Rheumatoid Arthritis			200 mW	0:20-0:40		
						Chronic: Daily for 3 days and then twice or three times a week until clinical effect is noted. A "maintenance phase" is established for conditions without permanent cure. E.g. laser therapy once every 2-4 weeks based on patient response.

*Hip*

Area Therapy Guideline:

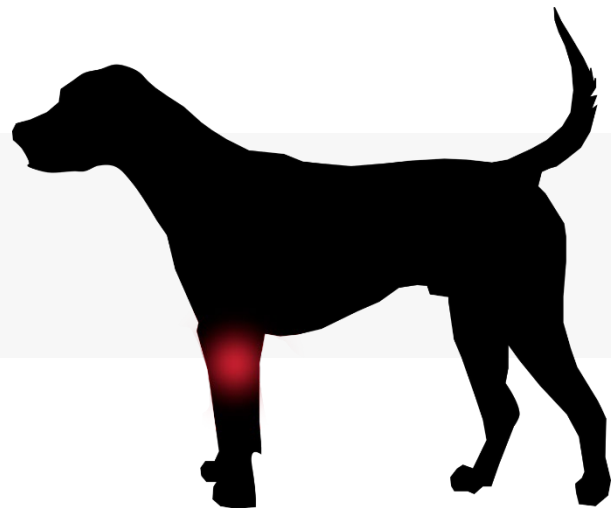
**Hip**

Diagnosis	Laser type	Dosage J/cm <sup>2</sup>	Time (min:sec)/cm <sup>2</sup>		Technique	Frequency
Arthrosis	IR	3-6 J/cm <sup>2</sup>	500 mW	0:06-0:12	Scanning or Point	<p>Acute: Daily until improved clinical response. Then twice a week and then once a week in a "transition phase" until condition is resolved.</p> <p>Chronic: Daily for 3 days and then twice or three times a week until clinical effect is noted.</p> <p>A "maintenance phase" is established for conditions without permanent cure. E.g. laser therapy once every 2-4 weeks based on patient response.</p>
Hip	L400		400 mW	0:08-0:15		
Dysplasia (HD)	L500 L2000		200 mW	0:15-0:30		



*Elbow*

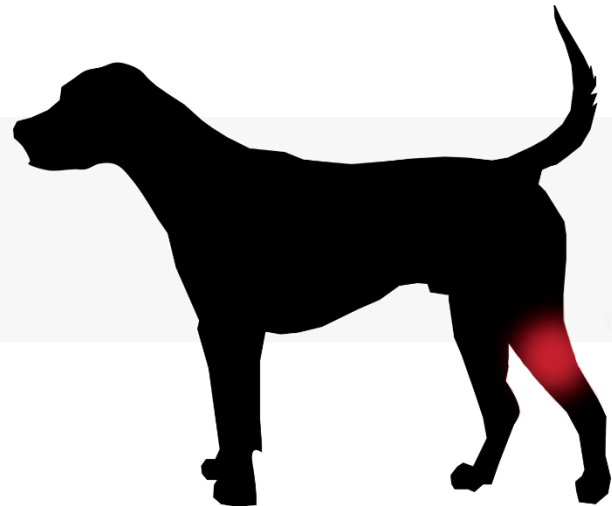
Area Therapy Guideline:

**Elbow**

Diagnosis	Laser type	Dosage J/cm <sup>2</sup>	Time (min:sec)/cm <sup>2</sup>		Technique	Frequency
Overuse of Ligaments and Tendons	IR	3-6 J/cm <sup>2</sup>	500 mW	0:06-0:12	Scanning or Point	Acute: Daily until improved clinical response. Then twice a week and then once a week in a "transition phase" until condition is resolved.
	L400		400 mW	0:08-0:15		
	L500					
Inflammation (Muscles, Tendons and Ligaments)	L2000		200 mW	0:15-0:30		Chronic: Daily for 3 days and then twice or three times a week until clinical effect is noted. A "maintenance phase" is established for conditions without permanent cure. E.g. laser therapy once every 2-4 weeks based on patient response.

*Knee/Stifle*

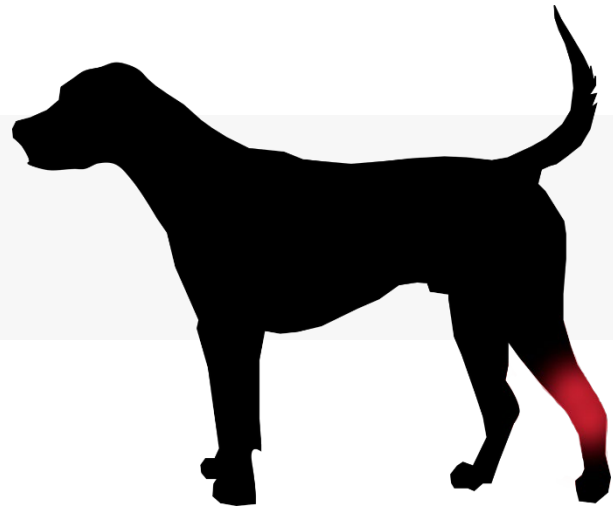
Area Therapy Guideline:

**Knee / Stifle**

Diagnosis	Laser type	Dosage J/cm <sup>2</sup>	Time (min:sec)/cm <sup>2</sup>		Technique	Frequency
Ligament Injuries (E.g. Cranial Cruciate Ligament)	IR	4-12 J/cm <sup>2</sup>	500 mW	0:08-0:24	Scanning or Point	Acute: Daily until improved clinical response. Then twice a week and then once a week in a "transition phase" until condition is resolved.
	L400		400 mW	0:10-0:30		
	L500		200 mW	0:20-1:00		
Contusions	L2000					
Joint Inflammation (Synovitis)						Chronic: Daily for 3 days and then twice or three times a week until clinical effect is noted.
Arthrosis						A "maintenance phase" is established for conditions without permanent cure. E.g. laser therapy once every 2-4 weeks based on patient response.

*Hock/Ankle*

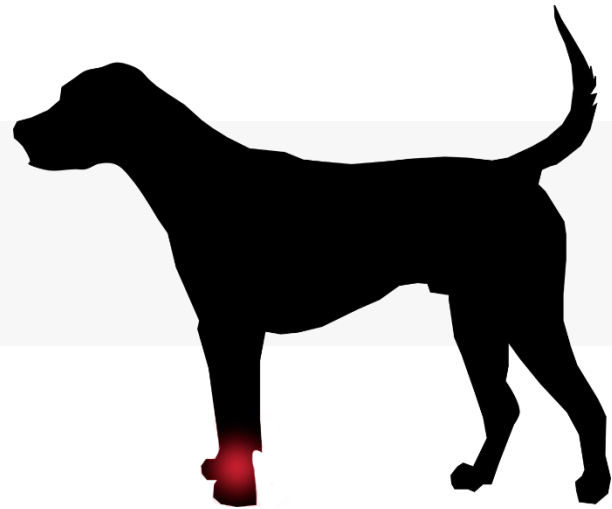
Area Therapy Guideline:

**Hock / Ankle**

Diagnosis	Laser type	Dosage J/cm <sup>2</sup>	Time (min:sec)/cm <sup>2</sup>		Technique	Frequency
Ligament Injuries (Torn or Stretched)	IR	3-6 J/cm <sup>2</sup>	500 mW	0:06-0:12	Scanning or Point	Acute: Daily until improved clinical response. Then twice a week and then once a week in a "transition phase" until condition is resolved.
	L400		400 mW	0:08-0:15		
	L500					
	L2000		200 mW	0:15-0:30		
Joint Inflammation						Chronic: Daily for 3 days and then twice or three times a week until clinical effect is noted. A "maintenance phase" is established for conditions without permanent cure. E.g. laser therapy once every 2-4 weeks based on patient response.
Arthrosis						

*Carpal/Wrist*

Area Therapy Guideline:

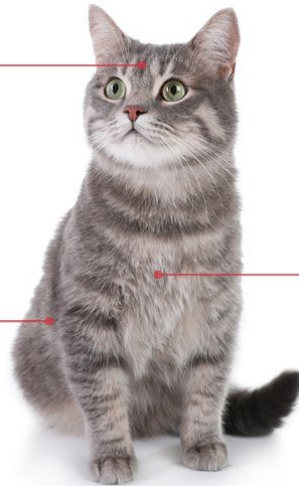
**Carpal / Wrist**

Diagnosis	Laser type	Dosage J/cm <sup>2</sup>	Time (min:sec)/cm <sup>2</sup>		Technique	Frequency
Arthrosis	IR	3-6 J/cm <sup>2</sup>	500 mW	0:06-0:12	Scanning or Point	Acute: Daily until improved clinical response. Then twice a week and then once a week in a "transition phase" until condition is resolved.
Contraction of Flexor Muscles	L400		400 mW	0:08-0:15		
Inflammation (Muscles, Tendons and Ligaments)	L500 L2000		200 mW	0:15-0:30		
						Chronic: Daily for 3 days and then twice or three times a week until clinical effect is noted. A "maintenance phase" is established for conditions without permanent cure. E.g. laser therapy once every 2-4 weeks based on patient response.

## Feline Dosage Guidelines

- Rhinitis and Sinusitis
- Feline Asthma

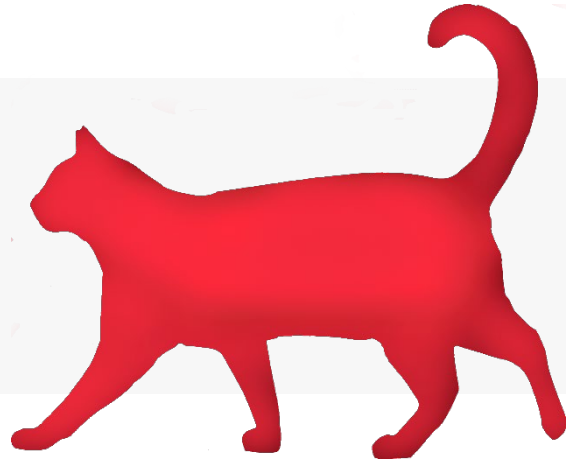
- Inflammatory Bowel Disease
- Pancreatitis
- Anal Sac Abscess



- Wound Healing
- Postoperative Incisions
- Fractures and Bone Healing
- Arthritis
- Hyperesthesia Syndrome
- Cat -Bite Abscess
- Allergic Dermatitis
- Cardiac Disease
- Feline Acne

## Specific Feline Dosage Guidelines

### Area Therapy Guideline: Feline Dosage Guidelines



Diagnosis	Laser type	Dosage J/cm <sup>2</sup>	Time (min:sec)/cm <sup>2</sup>		Technique	Frequency
Cat -Bite Abscess	RED	6-8 J/cm <sup>2</sup>	200 mW	0:30-0:40	Scanning or Point	1-3 sessions/week. When clinical response is noted frequency is reduced
	L200		100 mW	1:00-1:20		
	L800		50 mW	2:00-2:40		
Allergic Dermatitis	RED	2-4 J/cm <sup>2</sup>	200 mW	0:10-0:20	Scanning or Point	Individual – Depending on clinical response and healing progress. May need chronic treatment.
	L200		100 mW	0:20-0:40		
	L800		50 mW	0:40-1:20		
Cardiac Disease	IR	6-8 J/cm <sup>2</sup>	500 mW	0:12-0:16	Scanning or Point	Individual – Depending on clinical response. Often needs chronic treatment.
	L400		400 mW	0:15-0:20		
	L500 L2000		200 mW	0:30-0:40		
Anal Sac Abscess	RED	6-8 J/cm <sup>2</sup>	200 mW	0:30-0:40	Scanning or Point	Daily for 2-3 days and then every other day until the cellulitis and fitulous tracts have healed
	L200		100 mW	1:00-1:20		
	L800		50 mW	2:00-2:40		

Feline Acne	RED	3-4 J/cm <sup>2</sup>	200 mW	0:15- 0:20	Scanning or Point	1-3 sessions/week. When clinical response is noted frequency is reduced or treatment terminated if condition is resolved
	L200 L800		100 mW	0:30- 0:40		
			50 mW	1:00- 1:20		
Hyperesthesia Syndrome	RED	3-4 J/cm <sup>2</sup>	200 mW	0:15- 0:20	Scanning or Point	Individual – Depending on clinical response. Often needs chronic treatment
	L200 L800		100 mW	0:30- 0:40		
			50 mW	1:00- 1:20		
Wound Healing	RED	4-6 J/cm <sup>2</sup>	200 mW	0:20- 0:30	Scanning or Point	Daily until improved clinical response. Then twice a week and then once a week in a “transition phase” until condition is resolved
	L200 L800		100 mW	0:40- 1:00		
			50 mW	1:20- 2:00		
Postoperative Incisions	RED	3-4 J/cm <sup>2</sup>	200 mW	0:15- 0:20	Scanning or Point	Daily until improved clinical response. Then twice a week and then once a week in a “transition phase” until condition is resolved
	L200 L800		100 mW	0:30- 0:40		
			50 mW	1:00- 1:20		
Inflammatory Bowel Disease	IR	6-10 J/cm <sup>2</sup>	500 mW	0:12- 0:20	Scanning or Point	Individual – Depending on clinical response. Often needs chronic treatment
	L400 L500 L2000		400 mW	0:15- 0:25		
			200 mW	0:30- 0:50		
Pancreatitis	IR	8-10 J/cm <sup>2</sup>	500 mW	0:16- 0:20	Scanning or Point	Individual – Depending on clinical response
	L400 L500 L2000		400 mW	0:20- 0:25		
			200 mW	0:40- 0:50		

Fractures and Bone Healing	IR	6-10 J/cm <sup>2</sup>	500 mW	0:12-0:20	Scanning or Point	Daily until improved clinical response. Then twice a week and then once a week in a "transition phase" until condition is resolved
	L400 L500 L2000		400 mW	0:15-0:25		
			200 mW	0:30-0:50		
Feline Asthma	IR	6-8 J/cm <sup>2</sup>	500 mW	0:12-0:16	Scanning or Point	2-3 times/week and when clinical response is noted frequency is reduced
	L400 L500 L2000		400 mW	0:15-0:20		
			200 mW	0:30-0:40		
Arthritis	IR	6-10 J/cm <sup>2</sup>	500 mW	0:12-0:20	Scanning or Point	2-3 times/week. When clinical response is noted frequency is reduced
	L400 L500 L2000		400 mW	0:15-0:25		
			200 mW	0:30-0:50		
Rhinitis and Sinusitis	IR	8-10 J/cm <sup>2</sup>	500 mW	0:16-0:20	Scanning or Point	Individual – Depending on clinical response. Often needs chronic treatment
	L400 L500 L2000		400 mW	0:20-0:25		
			200 mW	0:40-0:50		



## References

1. Castano A P, Dai T, Yaroslavsky I, Cohen R, Apruzzese W A, Smotrich M H, Hamblin M R. Low-level laser therapy for zymosan-induced arthritis in rats: Importance of illumination time. *Lasers Surg Med.* 2007; 39 (6): 543-550.
2. Chow R T, Barnsley L. Systematic review of the literature of low-level laser therapy (LLLT) in the management of neck pain. *Lasers Surg Med.* 2005; 37 (1): 46-52.
3. Chow R T, Heller G Z, Barnsley L. The effect of 300mW, 830 nm laser on chronic neck pain: A double-blind, randomized, placebo-controlled study. *Pain.* 2006; 124 (1-2): 201-210.
4. Chow R T, David M A, Armati P J. 830 nm laser irradiation induces varicosity formation, reduces mitochondrial membrane potential and blocks fast axonal flow in small and medium diameter rat dorsal root ganglion neurons; implications for the analgesic effects of 830 nm laser. *J Peripher Nerv Syst.* 2007; 12 (1): 28-39.
5. Hashmi J T, Huang Y Y, Sharma S K, Kurup D B, De Taboada L, Carroll J D, Hamblin M R. Effect of pulsing in low-level light therapy. *Lasers Surg Med.* 2010; 42 (6): 450-466.
6. Godbold JC and Riegel RJ. Chapter 7: Contraindications, Special Considerations, and Precautions, *Laser Therapy in Veterinary Medicine: Photobiomodulation*, First Edition. Edited by Ronald J. Riegel and John C. Godbold, Jr., John Wiley and Sons, Inc., 2017, P. 67-73. ISBN: 9781119220114.
7. Godbold JC and Riegel RJ. Chapter 31: Fundamentals of Equine Laser Therapy, *Laser Therapy in Veterinary Medicine: Photobiomodulation*, First Edition. Edited by Ronald J. Riegel and John C. Godbold, Jr. John Wiley and Sons, Inc., 2017, P. 337-343. ISBN: 9781119220114.
8. Godbold JC and Riegel RJ. *Laser Therapy in Veterinary Medicine: Photobiomodulation*, First Edition. Edited by Ronald J. Riegel and John C. Godbold, Jr. John Wiley and Sons, Inc., 2017, ISBN: 9781119220114.
9. Rosin P and Fächtenbusch A. *Laser Therapy and Acupuncture on Horses – Treatment Protocols*, 1. Edition 2006, ISBN: 3-019199-2.
10. Rosin P and Fächtenbusch A. *Laser Therapy and Laser Puncture in Dogs and Cats – Treatment Plans*, 6. Edition 2018, ISBN: 978-3-00-030808-6.