New Trends in Pain Management and Tissue Rehabilitation

Class IV Laser Therapy: a Non-Pharmaceutical, Natural Solution

Available at Natterjacks Vet

Because we’re family!
Agenda

• Clinical Uses of K-Laser
• Bio-stimulation Science
  • Cellular Effects
  • Clinical Effects
• Necessities of Power and Multiple Wavelengths
• Protocols
• LLLT Studies
• Implementation
LASER

Light
Amplification by
Stimulated
Emission of
Radiation
Domestic Pets
Exotics Species
Used by Sports Professionals
Veterinary Practice Opportunities

- Osteoarthritis and DJD
- Pre/Post Surgical
  - Soft Tissue
  - Orthopedic
- Feline Pain Management
- Acute Injuries and Lameness
- Post Dental Treatment and Gingivitis
- Wound Management
- Extend Quality of Life
Science Behind
Low Level Light Therapy
Wavelength of Light
Therapeutic Spectrum
Photo-Biostimulation Cellular Effect

Absorption in water creates temperature differences at the cellular level.

Blood loves to flow down these gradients.

Oxygenated Hemoglobin ($HbO_2$) 

De-Oxygenated Hemoglobin ($Hb^+$)

Molecular Oxygen for the cell to metabolize

Cytochrome C Oxidase

Secondary & Tertiary Effects

Calcium Transport  
Bradykinin Regulation  
Collagen Regulation  
DNA Replication (Mitosis)  
Pain Relief
Physiological Effect –
Pain Management & Anti-inflammatory

- The proton gradient across the cell membrane is positively influenced by the photon energy absorbed by trans-membrane proteins, influencing the concentration of electrolytes.
- Reduction in inflammatory markers (PGE$_2$, IL-1$\beta$, TNF$\alpha$).
- Selective reduction in pain modulation through the A$\delta$ and C-fibre pathways has been recorded:
  - Axonal disruption of neuronal flow
  - Inhibition of neuronal enzymes

Physiological Effects – Overall

• There is an absolute increase in micro-circulation, higher levels of ATP, RNA & DNA synthesis, and better tissue oxygenation.

• Additional anti-inflammatory, analgesic and anti-oedematous effect on tissues via gated C pathways.

• Increased absorption of interstitial tissue fluid, better tissue regeneration and stimulation of analgesic effect.
Is Power a Factor?

*Power and wavelength of light enhances the speed for penetrating tissues.*

- **Class I** - DVD writer (enclosed)
- **Class II** - Check-out counter (exposed)
- **Class III** - Pen pointer max. 0.5 W (superficial tissues)
- **Class IV** - Greater than 0.5 W (deeper tissues)
  - Industrial Lasers & Surgical Cutting Lasers
  - Therapeutic Bio-stimulator Lasers
Laser Tissue Interaction

Biological tissue is a highly turbid medium; that is, it strongly (exponentially) attenuates radiation through a combination of scattering and absorption.
Necessity of Higher Power

**Surface** dose is **not** the end of the story. The **important** quantity is **dose at depth**. *In vitro* studies tell us how much dose is needed to get a **biological response**. Our protocols work **backward** from there to calculate how much **power** we need to **start** with at the **surface**.

We are the **only** company in the industry who has **compiled** this data and **accounts** for tissue attenuation in its **protocols**. Combine this analysis with **average power densities** and **treatment times** to get **dose** at depth.
Necessity of Higher Power

2\textsuperscript{nd}-order Approximation: MRI-Monte Carlo Stimulation
Necessity of Higher Power
Depth of Penetration

In-vivo receptors -
test for Photon Density at Depth
INTRODUCTION

Internal dosimetry of laser therapy is often overlooked or "questioned", but it is a crucial information for the design of treatment protocols and prediction of biological effects in vivo studies have given a general idea of the range of biophysical effects, but their results do not and should not be strictly extrapolated to form conclusions in vivo. The science of dosimetry has been extensively developed in terms of beam qualities and various methods for dosimetry, but to date, there is no method that can accurately predict the effects of laser therapy in biological tissues. Here, we present some of these methods as we aim to bridge this gap and understand exactly how dose is distributed as depth in the body.

MATERIALS and METHODS

Wavelength selection was performed with a spectrometer equipped with a fiber optic bundle and an optical power sensor. The light output was then measured with a photodiode array. All experiments were performed with a power density of 1000 mW/cm² and a wavelength of 870 nm. The results were compared to the untreated tissue and the laser treated tissue.

2.1 First-Order Approximation

Power input was measured using the ENDOR (Excimer Laser Diode, Erlangen, Germany) technique. First-order predictions were made from power measurements on single laser beams, assuming that the beam remains in a single laser beam as it passes through the tissue. The laser was focused on a 1 mm spot to maintain alignment with the fiber optic. The beam was then propagated through the tissue, and the power density at the focus was measured. The power density was then used to calculate the absorption coefficient.

2.2 Second-Order Approximation

Combining techniques of radiation oncology and neurosurgery, simulations can be performed to give the most accurate prediction of tissue damage. Monte Carlo simulations using the NCSU Monte Carlo Code for tissue (MCC) have been used to calculate the dose distribution.

REFERENCES


Frequency Modes

• Continuous Wave (CW)
  – 0.1 to 15 Watts

• Frequency Modulation
  – 1 – 20,000 Hz

• Intense SuperPulse
  – 20 Watt Peak Power
  – Average up to 15 Watts
Frequency Modes

Intense SuperPulse
DELIVERY MODE

Continuous Wave (CW), Frequency Modulated, or SuperPulse

Different Tissue Types Respond to Different Frequencies
Starting Point

12 Watt LED

Final Power

through 1 cm diameter spot
Area = .785 cm²
0.08 Watts

through 6 cm diameter spot
Area = 28 cm²
0.49 Watts

Power Density
(at 12 Watt Output)

0.01 - .10 W/cm² (depends on distance to target)

12 Watt LASER
w/ "FIXED" SPOT SIZE

"Fixed" means slightly divergent, so pulling away from the surface increases spot size and decreases power density.

12 cm²
0.33 Watts

12 Watts
0.43 W/cm² (fixed)

10 cm ~ 4 in

12 Watt ZOOMABLE LASER

Also slightly divergent, but can adjust spot size to keep consistent power density.

12 Watts

12 Watts
0.43 - 15 W/cm² (adjustable with zoom-handpiece)
Multiple Wavelengths

What about multiple wavelengths?
Multiple Wavelengths

What about multiple wavelengths?

660+800+905+970

Depth Curve becomes the Average

Subcutaneous
Soft Tissue
Bone/Joint
Center of Joint
Multiple Wavelengths

What about multiple wavelengths?

Knowing this, we can formulate a protocol for the hip, e.g.
Class III versus Class IV Lasers

### Lumbar Pain (Chronic)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Class IIIb (ej 200 mW)</th>
<th>K-Laser (12,000 mW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biostimulatory Dose</td>
<td>6 J/cm²</td>
<td></td>
</tr>
<tr>
<td>Tx Area</td>
<td>150 cm²</td>
<td></td>
</tr>
<tr>
<td>Energy Desired AT TARGET</td>
<td>900 J</td>
<td></td>
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<tr>
<td>Depth of Target</td>
<td>6 cm</td>
<td></td>
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<tr>
<td>% Intensity Delivered at Target Depth</td>
<td>29%</td>
<td></td>
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<tr>
<td>Energy Necessary at Surface</td>
<td>3220 J</td>
<td></td>
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<tr>
<td>Treatment Time</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Seconds</td>
<td>16,100</td>
<td>268</td>
</tr>
<tr>
<td>Minutes</td>
<td>268</td>
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</tr>
<tr>
<td>Hours</td>
<td>4.5!!</td>
<td>0.07</td>
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Musculoskeletal Injury, Osteoarthritis and Pain Management

- Improves and Promotes Healing
- Relieves Pain and Reduces Spasm
- Increases Joint Flexibility
- Improves Peripheral Microcirculation
- Anti-inflammatory Action
K-Laser Trial - OSU

• 27 dogs with Cranial Cruciate Ligament Injury
• Half = K-Laser pre-TPLO surgery; Half = Placebos
• Blinded, placebo-controlled trial - no post operative laser
• Both groups received the same treatment protocols after the initial laser session: post-op Carprofen, Tramadol and Cryotherapy
• Same team of boarded surgeons and radiographers reviewed the dogs’ lameness (force plate analysis) and radiographs at pre-operative and 8-weeks post-operative intervals
Force Plate Analysis

- Pre-op Peak Force (%BW)
  - 23.8% +/- 3.6% Control
  - 26.3% +/- 3.7% Lasered

- 8 Weeks Post-Op
  - 28.9% +/-2.6% Control
  - 39.6% +/- 4.7% Lasered

- P<0.01 Laser Treatment

- 26% improvement in Control
- 51% improvement in Lasered
More Than Pain Relief – Improved Healing in Bone Tissue

Results indicate that bone irradiated with infra-red wavelengths show increased osteoblastic proliferation, collagen deposition and bone reformation when compared to non-irradiated bone.

Further the effect of laser therapy is more effective if the treatment is carried out at early stages when high cellular proliferation occurs.

“Effect of Low-Level Laser Therapy on Bone Repair: Histological Study in Rats” - Pretel, Lizarelli, Ramalho
Non-Union Fracture – Greg Hayes, DVM

- Patient / Condition
  - Ursa, Rotweiler
  - Non-healing fracture (48 days)

- K-Laser Treatment
  - Fracture Bone Setting
  - 2 treatments over 3 days

- Outcomes (see images)

"...the laser was used over a non-healing fractured metatarsal on an older Rottweiler. At seven weeks we were facing a malunion at which time we used the laser on a bone setting of 4 watts. Nineteen days later, as our staff and board certified radiologist evaluated the radiograph, there was simply a feeling of disbelief. I hesitate to overstate this, but I have seen enough malunions to know what was accomplished here. The fracture site was healed. “ Greg Hayes, DVM
Osteoarthritis Case – Rocky Richardson

**Patient:** Rocky Richardson, Black and Tan, German Shepherd Dog
10 years 5 month old, Male neutered, 41.50kg

**Practice:** Wingrave Vets in Epsom referred to Molesey Veterinary Centre

**History:** Skin, gastrointestinal and osteo-arthritis disorders
- Damaged Left Elbow March 2009
- Sudden onset lameness Left Hind leg July 2010
- Became more irritated and aggressive as osteoarthritis progressed

**Therapy:** Combination of Seraquin, Tramadol, Metacam, Steroids, and Hydrotherapy

**K-Laser:**
- 12.11.2011 started using K-Laser - Right Hip, Lumbosacral area and both Elbows protocols
- 17.11.2011 owner reported that the dog was much brighter and happier demeanour.
- 19.11.2011 after 2nd K-Laser Rocky jumped into the back of the car for the first time in years.
- 24.11.2011 staff at the stables commented on how much livelier and happier Rocky appeared.
- He started playing around in the grass and with other people.
- 26.11.2011 Rocky was able to run around pain-free and jump into the back of the car easily.

**Prognosis:** Rocky Richardson now has regular 3-4 month sessions at Molesey Veterinary Centre under the care of the rehabilitation Molesey nurses and continues to improve.
Elbow Dysplasia – Taylor Brux

**Patient:** Taylor Brux, American Bulldog Cross, Battersea Dogs  
2 years old, Male neutered, 38kg

**Practice:** Clerkenwell Veterinary Hospital in London

**History:** Diagnosed Bilateral Elbow dysplasia  
Constant pain medication, lead rest, diet and supplements  
Lameness despite multi-modal therapy  
29.07.2011 Subtotal choroidectomy on left elbow

**Therapy:** Surgery, Tramadol, Metacam and Seraquin and lead rest

**K-Laser:** Despite successful surgery owner felt dog showed little improvement  
8 weeks post op of Metacam – unable to wean off NSAIDs as lameness got worse  
17.10.2011 Both elbows were given light coat elbow setting on K-Laser: 3 1st week, and twice per week for the following two weeks  
After three weeks of K-Laser Taylor came off Metacam and Tramadol altogether  
Maintained on every other week K-Laser session without any further medication

**Prognosis:** Taylor’s owner seen that K-laser has improved Taylor’s quality of life, and she is now, for the first time, comfortable moving about on both of her elbows. Has 15 minutes once every 2 weeks, owner happy that her dog is happy and comfortable without relying on pain medication.
Veterinary Testimonials - UK

“We have had a large number of successes that can only be put down to the influence of the K-laser. They include: a rapid resolution of a difficult infected, non-union plated forelimb fracture referred from another practice, improved recovery times after TPLO surgery, significant pain reduction and improvements in lameness of animals with elbow arthritis or degenerative joint disease where NSAIDS have ceased to be effective.”

Mark Lindfield MRCVS, Director - Clerkenwell Veterinary Hospital

“Not only from a post-surgical pain/inflammation viewpoint, but also from animals which have been struggling with osteoarthritis for a long while. The most successful case so far is a 5 year old Lab which has been struggling with OA due to bilateral elbow dysplasia since only a few months old... it's had every form of treatment to date, with only mildly satisfactory results. Since starting laser therapy, the dog is now able to get up without difficulty, exercise well, and bound around like it’s wanted to do for years”

Shaun Smith BVetMed, Cert SAS, MRCVS – Northlands Vet Hospital
Repair on Partial Calcaneous Tendon Tissue Injury

Methodology:
- Controlled, randomised, blinded study, 8 day study
- 12 control, 42 study rats with systematic Achilles tendon damage
- Group 1 = control; Group 2 = no laser;
- Group 3, 4 and 5 had 3, 5 and 7 day of consecutive laser therapy respectively
- Day 8 sacrificed and collagen microscopic analysis

Results:
- Significant difference between Group II and IV
- No significant difference between Group I and Group IV (p<0.999)
- No significant difference between all three laser rat groups in healing of the tendon

Conclusion:
- LLLT was effective in the improvement of collagen fibres organisation of calcaneous tendon after undergoing a partial lesion.
Torn Achilles Tendon – George McKay, DVM

- **Patient/Condition**
  - Dooley, English Mastiff
  - 55kg Male Neuter
  - Non-weight bearing R hindlimb
    - Torn Achilles tendon
    - Laxity in tarso-crural joint
  - Ligament surgery recommended by previous veterinary surgeon after ultrasound of injured ligament

- **K-Laser Treatment - Mobile Vet Service**
  - Stifle Protocol
  - 6 treatments over 3 weeks
  - Robert Jones Splint until treatment 5
  - Introduction of controlled walking and hill work
  - 4 weeks, no lameness and no tear
Wound Management

• Improves and Promotes Healing
• Relieves Pain
• Improves Flap Survivability
• Improves Peripheral Microcirculation
• Reduces infection
• Anti-inflammatory Action
RTA – Shay O. (8 year old spayed female)

**Veterinary Surgical Center Initial Presentation**

- March 29th 2011 – Exploratory for suspected right side abdominal muscular hernia
- April 15th 2011 – Skin sloughing & surgical debridement
- Wet-to-dry bandages
- Limited improvement

**Kindness Small Animal Hospital**

- Dr. Aaron Neeman owner of K-Laser

**K-Laser 1st Treatment – April 27th of 2011**

- Contaminated Wound Protocol (5W, 2 cycles, 1125J)
- 1 week, 4 treatments in one week
Shay O. – May 11th 2011 Pet Owner Comments

“Thank you Dr. Neeman for all of your help, and saving Shay. We were on the verge of euthanizing her because we were being told she needed $5000 -7000 of skin grafts, and we just couldn't afford that. Now, not only is her skin almost completely healed in such a short amount of time, but she's doing great on her leg! All thanks to you and your laser.”
Snake Bite Wound
Snake Bite Wound

12 Days - 3 Laser Treatments

6 days after 1st Treatment
“We have had a large number of successes that can only be put down to the influence of the K-laser. .......impressive wound healing where significant skin loss occurred after a dog attack meant that a large area of secondary intention healing needed to take place.”

“In addition a post-TECA operation; non-healing, bullar inflammation seen using our CT scanner and causing a persistent head tilt that no medication seemed to be able to improve. After a few sessions with the K-Laser the dog was cured, the abscess was gone and no further head tilt occurred.”
K-Laser – Plasmacytic Stomatitis

History:
Lymphocytic Stomatitis in an American DSH.
Excessive drooling and non-responsive to NSAIDs.
FIV positive

Vet Surgery:
Alamo Feline Health Centre, San Antonio, Texas.

K-Laser Protocols:
6 treatments begun on the 28th of May 2008 (see photo 1)
Oedema and Congestion on initial therapy, followed by Contaminated Wound setting

Results:
Patient ceased drooling after initial treatment. Returned to normal appetite and lesions receded. (see photo 2 18th of June 2008)
K-Laser Typical Protocol

- **Chronic Musculoskeletal**
  - 6 Treatments
  - 3, 2, 1 or 2, 2, 2 over 3 weeks

- **Acute Injuries**
  - 3 - 6 Treatments
  - 3, 2, 1 or 2, 2, 2 over 3 weeks

- **Pre/Post Surgery**
  - 2 – 6 Treatments
  - Consultation day & Pre-operation
  - Anaesthetic recovery (Incision only)
  - Discharge day & Suture Removal day

- **Wounds**
  - Can be given daily
K-Laser Coverage by Pet Insurance

- ONLY Therapeutic Laser covered by ALL top UK Pet Insurance Companies for Vet treatment coverage
- One UK Pet Insurance Company Director bought a vet practice our Cube 4 Laser for her local practice she was so impressed with the results
Any Questions?

Visit the website:

www.myklaserpet.com