

Laser Acupuncture and Local Laser Therapy in Veterinary Medicine with Overview of Applied Laser Types and Clinical Uses

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ABSTRACT

Local laser therapy or low level laser therapy (LLLT) has been enjoying increased popularity in recent years in both human and veterinary medicine. It provides excellent healing in traumatized or infected tissue by increased energy (ATP) in diseased tissues which have high energy requirements, provides peroxide clearance and restructures abnormal dense connective tissue (e.g. in tendonitis). Acupuncture and LLLT are separate treatment modalities, but the synthesis of these two very effective therapies allows local healing of diseased tissue with LLLT supported by acupuncture as an autonomous regulating therapy. It is important to emphasize that the resulting “laser acupuncture” not only means the stimulation of the acupuncture point by the laser beam instead of the needle, but that the local tissue healing effect of increased ATP production by laser light supplements acupuncture as an integral part of the therapy. It is important to differentiate between the different types of lasers (continuous wave versus pulsed wave) and the different features that are associated with laser effects such as: wavelength, power output and resonance frequencies. When evaluating appropriate laser units for use in veterinary laser acupuncture, the pulsed lasers with a 90 watt pulse peak and 904 nm wavelength are featured as they achieve high penetration depth with sufficient application of laser photons in traumatized or infected tissue, without a thermal reaction in the tissue. For veterinary acupuncturists, the addition of low level laser therapy and laser acupuncture can be used in addition to any thinkable acupuncture treatment which gives additional options for achieving optimal results.

Key words: 904nm pulsed laser, impulse laser, low level laser therapy, acupuncture, laser acupuncture, horse, dog

ABBREVIATIONS

LLLT	Low level impulse laser therapy
W	Watts
TCVM	Traditional
Hz	Hertz
Fr	Resonance Frequency
Rf	Reninger
mW	Milliwatts
cw	Continuous Wave
nm	Nanometers

Low level laser therapy (LLLT) has been used approximately 25 years and is one of the most underestimated therapies in veterinary and human medicine. One of the primary reasons for its slow acceptance has been the use of a plurality of laser types which has led to widely differing study results. The long-known fact that laser light can be converted directly into the cellular energy, ATP, was reconfirmed by

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Michael Hamblin of the Harvard Medical School and the Massachusetts Institute of Technology (MIT), after this laser effect was originally discovered in the 70s by T. Karu and U. Warncke.^{1,2,3,4}

Acupuncture and LLLT are separate treatment modalities, but the synthesis of these two very effective therapies allows local healing of diseased tissue with LLLT supported by acupuncture as an autonomous regulating therapy. It is important to emphasize that the resulting “laser acupuncture” not only means the stimulation of the acupuncture point by the laser beam instead of the needle, but that the local tissue healing effect of increased ATP production by laser light supplements acupuncture as an integral part of the therapy. Acupuncture and local laser therapy are two therapies of equal value, each very effective by itself that in combination lead to a total holistic therapy approach.

Acupuncture and Laser Theory

Acupuncture

Acupuncture has become an effective therapy for many different disorders in both human and veterinary

medicine.⁵ It is an important component of traditional Chinese veterinary medicine (TCVM) which is an entire system of disease diagnosis and treatment based on 3000 years of tradition, experience and research since the time of Sun Yang (Bo Le), the father of veterinary acupuncture. The Channels and TCVM functional cycles play fundamental roles and are responsible for the smooth transport of Qi (e.g. the sum total of the substances and physiological activities of the body). The current understanding of conventional anatomy and physiology can be useful to increase the understanding of ancient TCVM concepts. One form of Qi from a conventional perspective is adenosine triphosphate (ATP) produced by the citric acid cycle (tricarboxylic acid and Krebs cycle) responsible for aerobic respiration within the mitochondria of the body. Aerobic respiration produces ATP that provides the body with energy (Qi) for all life processes from the synthesis of enzymes to the relaxation of muscles. In all diseases, there is a disturbance of the optimum flow of Qi that results in a loss of balance between *Yin* (e.g. the parasympathetic nervous system) and *Yang* (e.g. the sympathetic nervous system).⁵

When a disease irritates afferent nerves, pain and reflex contraction of local muscles and blood vessels restricts the free flow of Qi (ATP) with resulting Blood and Qi Stagnation. The Qi/Blood Stagnation results in Deficiency of Qi (ATP) and Blood (nutrients) to local tissues. Since Qi (ATP) is necessary for muscle relaxation, a vicious cycle of contraction and vascular occlusion occurs and further worsens the Stagnation of Qi and Blood. Further, autonomic reflex connections to internal organs can be affected that result in organ Qi and Blood Stagnation and Deficiency (e.g. disease of the upper thoracic vertebrae can affect the autonomic control of the heart).⁵

Laser

In Western medicine, the production of ATP (Qi) is recognized as occurring primarily through mitochondria production (mammals) or photosynthesis (plants). In plants, it is known that the transfer of light energy into cell energy during photosynthesis occurs due to the chlorophyll present in green leaves. Thanks to the chlorophyll, the plants can use sunlight directly for ATP genesis to produce the necessary building blocks and the energy needs of cell metabolism. Mammalian cells are not able to use sunlight for energy generation and ATP generation is only possible by oxidative phosphorylation in the respiratory chain of mitochondria. Laser light is different from normal sunlight in that it sends strong light clusters that due to laser properties reach the redox system of the respiratory chain in the mitochondria. According to Warnke, the absorption of laser light works via a so-called “antenna pigment” which links it to the respiratory chain in the mitochondria.^{3,4} The system takes up light in the average wavelength range of 900nm with a range of 600 to 1400nm.

According to Hamblin, Karu and Warnke, the conversion of laser light into cellular energy (ATP), particularly benefits diseased cells and cells in pathologically altered tissue, which have a particularly high energy demand^{1,2,3,4}. Likewise, a strong boost of energy by the laser light in nerve cells at an acupuncture point can generate an action potential similar to acupuncture needle stimulus effect^{1,2}. This fascinating discovery that the laser light is directly converted to ATP in the flavoprotein-metal- redox- system of mitochondria, was confirmed and continued by investigations of Michael R. Hamblin¹. Michael R. Hamblin is Associate Professor at Harvard Medical School and director of the Wellman Center for Photomedicine at Harvard Medical School and MIT. This confirmation from a well-known scientist at a prestigious



Figure 1: Laserpen (70 mW, 785 nm, cw laser), Reimers & Janssen, Berlin, Germany.

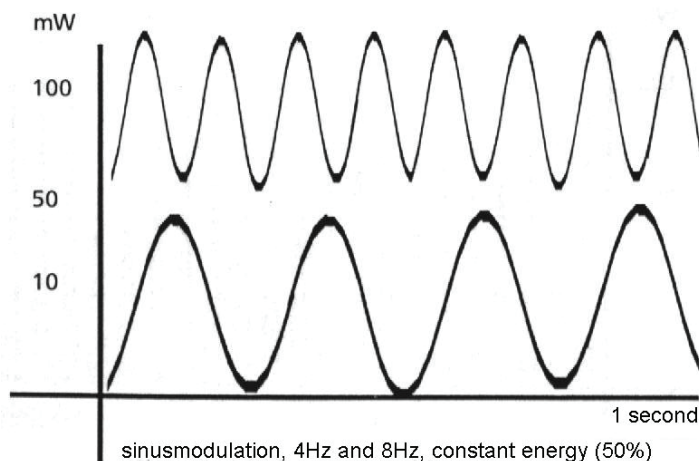


Figure 2: 8 Hz, oscillating between 50mW and 100mW; 4 Hz oscillating between 0 and 50mW; mW = milliwatt

institute has led to the increasing use and popularity of laser technology, especially in the USA.

This direct provision of energy in the form of additional ATP provides an excellent local effect with laser therapy. The laser light provides cells with urgently needed ATP (similar to increasing local Qi in acupuncture), which provides clinical effects such as relaxation of muscle spasms associated with abnormal vertebral body alignment (spondylosis), the maintenance of depleting organ functions and repair of wounds. The additional energy aides in removal of wound debris which blocks synthesis of new components for healing and assists in restructuring damaged tendon tissue with the incorporation of new collagen fibers⁶. Other important properties of infrared laser light is its ability to increase clearance of peroxide radicals which provide an outstanding effect against infectious organisms both in wounds and organ tissue.^{7,8} If the therapist has sufficient experience, laser therapy can be used without any adjuvant therapy, such as antibiotics. This independence from antibiotics is of particular importance when it comes to infections with antibiotic resistant pathogens. A final characteristic of the laser light that supplements the increased energy to tissues is the promotion of blood circulation, specifically in microcirculatory disorders, such as in equine laminitis.^{9,10}

Laser Selection

Laser Types

There are 2 types of lasers based on wave production: continuous wave (cw) or impulse (pulsed) wave. The continuous wave (cw) laser (Figure 1), has a continuous output of power. As an example, class 3B lasers (cw) would have a continuous wave output of 30-500 mW (milliwatt) (Figure 2) and class 4 (cw) would have a continuous wave output of 1-8W (watt). In the second type of laser, the *impulse laser*, also named *pulsed laser* or *superpulsed laser* (Figure 3), the laser energy is emitted in the form of single very strong light pulses. The individual

light pulses have power spikes from 30-100W, about 1000 times more power output than a continuous wave laser in the same class. The emitted high energy pulses, however, are of very short duration, only 200 nano-seconds each (Figure 4). These quick high pulses of energy provide much greater tissue penetration by the laser light, but due to the short duration of the light flashes, even at high pulse frequencies of modern lasers (up to 40,000Hz), no thermal or even coagulating effect in tissue has been seen^{11,12}. This has the great advantage of deep tissue penetration without emitting so much energy that it heats up or burns the tissue at the surface as may occur in continuous wave lasers.

Laser Classes, Laser Power and Wavelength

In addition to consideration of the laser type (continuous vs pulsed), there are 3 additional defining features to consider when comparing lasers. These are power output (mW or W), wavelength (nm) and resonance (Hz). Lasers are divided into a number of classes (1, 2, 3A, 3B, 4) depending upon the power output (energy) of the beam and the wavelength of the emitted radiation (Table 1). Laser power (mW/W), is mainly responsible for the penetration depth and the energy output per time (Joule), which both together are responsible for a sufficient number of laser photons being transported deep into the tissue where the energy is needed. Wavelengths suitable for veterinary laser therapy operate primarily in the infrared range (780-1400 nm) which is an important criterion for depth of tissue penetration (along with power output) and is necessary for stimulation of acupuncture points.^{1,2,3,4}

Resonance

In biology, resonance frequencies are of extreme importance and largely determine the therapeutic effect of laser treatment. The continuous laser beam is modulated by a specific resonance frequency (Hz) while in the impulse laser, the resonance frequency (Fr) is achieved by the Fr of the light pulses. The three most important



Figure 3: Physiolaser (2x 90 Watt, 904nm, impulse lasers), Reimers & Janssen, Berlin. Germany.

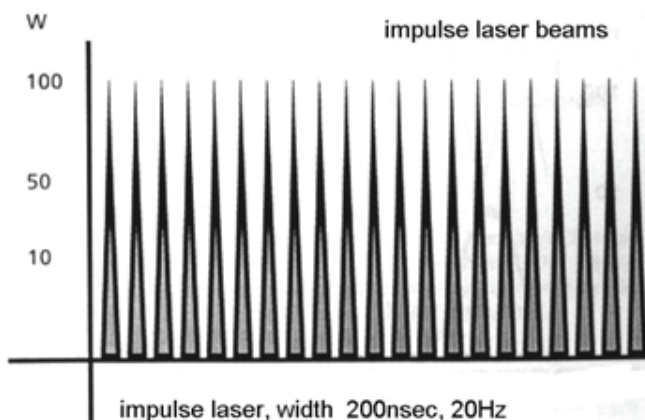


Figure 4: Impulse laser with 100Watt pulse peak power (the width actually is smaller than shown in the figure).

currently used series of resonance frequencies are Nogier, Bahr and Reininger (Table 2).^{13,14,15}

The most commonly used laser Fr series are those according to Nogier¹³. The French acupuncturist Dr. Paul Nogier, who discovered the laser for the use of acupuncture, also developed these frequencies (Table 2). He established a range of 7 frequencies named A', B', C', ...G'. The Fr A' (292Hz) is the most important one, since it is the resonance used to treat inflammation (e.g. wound infections, joint inflammation, organ inflammation).

Modern high tech lasers provide the high Fr A'' with 37,376 Hz which provides 128 times more energy per time than Fr A'. Frequency C is the "orthopedic" Fr and is used both for treating orthopedic acupuncture points in auricular medicine (ear acupuncture) as well as the local treatment of joints and the entire spinal column (especially blockages of the spine). Frequency E is the resonance used to treat nervous tissue and spinal cord.

The Bahr frequencies, also a series of 7 frequencies B1, B2, B3, ...B7 are very important for the pulse controlled

Table 1: Laser classes are defined by wavelength and power output

Laser Classes	Power Output*	Wavelength	Example
Class 1			Laser Printer
Class 2	0-1 mW	Visible light	Laser Pointer
Class 3 A	< 5 mW	Visible light 400-700 nm	Laser sights-firearms
Class 3B	5-500 mW	Infrared 700-1400 nm	LLLT, Laser Medical Device
Class 4	>500 mW	Infrared 700-1400 nm	Laser Medical Device

*Continuous Wave (cw); pulsed wave peaks have higher power output

Table 2: Comparison indications and attributes of the Nogier, Bahr and Reininger frequencies used for low-level impulse laser therapy and laser acupuncture

Nogier Frequencies																									
Frequency		A’/A’’		B’		C’		D’		E’		F’		G’											
Hz		292/37376		584		1,168		2,336		4,672		9,344		18,688											
Indications		Wounds, inflammation, irritable foci in body and teeth		Tendonitis, arthritis, fractures, organ acupoints		Tendonitis, arthritis, fractures, all body acu-points except feet		Acupoints of the feet		Nerve and spinal cord diseases		Mandibular joint and subcortical brain disorders		Cerebral cortex and mental disorders											
Bahr Frequencies																									
Frequency		1		2		3		4		5		6		7											
Hz		599.5		1,199		2,398		4,796		9,592		19,184		38,368											
Indications and Attributes		Deep tissue layer, “deep” points (source of illness, related to the sympathetic system)		Central tissue layer, “subse-quent” points (related to the parasympathetic system)		Surface tissue structures, Omega <i>Ren</i> Channel		Omega <i>Du</i> Channel		Opening acupoints of the Eight Ex-traordinary Channels		Governing Vessel		Conception Vessel, “hidden” foci in teeth											
Reininger Frequencies (Meridian Frequencies)																									
Channel		LIV		ST		HT		PC		LI		GB		KID		BL		SP		TH		SI		LU	
Hz		442		471		497		530		553		583		611		667		702		732		791		834	

*Used for treatment of acupoints on specific Channels and topical treatment of related organs; LIV=Liver, ST=Stomach, HT=Heart, PC=Pericardium, LI=Large Intestine, GB=Gallbladder, KID=Kidney, BL=Bladder, SP=Spleen, TH=Triple Heater, SI=Small Intestine, LU=Lung Channels

acupuncturists for acupuncture diagnosis and therapy.¹⁴ Frequency B5 is also important for the local treatment of inflammation as an alternative to Fr A' in impulse lasers that do not have the high Fr A". Frequency 7 (299.5 Hz) is a resonance Fr for treatment of another kind of disturbing foci in the teeth, so called "hidden disturbing foci". Here again, similar to A' and A", only new high tech lasers will have high Fr 7' with 38,386 Hz, which is 128 times more energy per time compared to Fr 7.

The Reininger frequencies have specific resonance to the individual Meridians and organs which they are representing.¹⁵ Thus, the Reininger Fr, Heart, is used for optimal treatment both for all acupoints of the Heart Meridian as well as for the local treatment of the heart muscle. The same applies to all other Meridian frequencies, such as the Kidney, Liver, Lung etc.

Selection of Laser Unit for Veterinary Clinical Use

When choosing a therapy laser, it is very important to identify an individual veterinarian's needs and to select a laser best suited for the clinical cases it will be used for. Suitable lasers for LLLT primarily belong to Class 3B lasers and more recently, Class 4 lasers, which differ in average energy output. The Class 3B lasers have a maximum of 500milliwatts (continuous wave power, or averaged power for impulse lasers). Class 4 lasers (continuous wave) are characterized by high power (up to 8W) and were designed initially for laser surgery. Since there is "light off" between the single pulses of high intensity in pulsed lasers, over time the average emitted energy from the 3B laser is lower than in Class 4 lasers. Although Class 4 lasers have a higher continuous wave power output when compared to Class 3B impulse lasers (8W versus 500mW), the impulse laser can produce the same amount or greater power during their peak spikes (90W versus 8W).

Other considerations for suitable LLLT lasers is to look for wavelengths in the infrared range (780-1400) and units that can program Nogier and Bahr resonance frequencies (usually not available in Class 4 lasers).^{1,2,3,4} In the author's experience (28 years of daily use), the 904nm (wavelength), Class 3B *impulse laser* (super pulsed to 90W), Physiolasera, gives the best benefits. The only exception is the local treatment of the eye, where the continuous wave laser with 70mW is applied (Laserpen^b). The impulse lasers (90W) can provide sufficient energy to stimulate acupuncture points, support tissue regeneration, wound healing and infection control even at considerable tissue depth, such as needed for equine work without generating excessive damaging heat as can be seen with Class 4 units.^{8,10,11,12}

Treatment Principles

Laser energy and energy dose

When treating a diseased tissue locally (LLLT) or performing laser acupuncture; careful consideration should be given to the amount of energy that needs to be supplied

to a tissue for optimal tissue effect (energy dose). Laser energy (Joule), is the amount of energy that is delivered to the tissue or to the acupuncture point. The absorbed energy in the target area, which provides usable energy for the organism, is determined by 3 factors: the laser power in watts, the depth of the pathological process and the irradiation time. Based on the author's experience, it can be assumed that an optimal effect on superficial structures, such as an acupuncture point with an impulse laser (90W peak pulse power), is achieved with an exposure time of approximately 20-40 sec. This corresponds to an applied energy of 0.3 to 1 Joule. In deep wounds, tendonitis, spondylosis, kissing spines, arthritis, laminitis, organ diseases (topical transcutaneous treatment) or deeper infections, there will need to be an increase in the duration of therapy to 2-3 minutes per location.

It must be emphasized that with an impulse laser, the emitted energy dose depends on the number of emitted light pulses, since each pulse represents a unit of energy. There is a significant difference between the "normal" infection Fr A' with 292 Hz and the "high" infection Fr A" with 37,376 Hz. The energy output per time in a 90W impulse laser, at the higher Fr A" is 128 times higher than the "normal" Fr A'. To apply 10 Joule of energy with Fr A' (292 Hz) will require 32 min. The same amount of energy provided by the laser with Fr A" (36,368 Hz), will require only 26 sec.

It is particularly important to point out that the therapy success described by the author has been achieved solely with a 90W, 904nm pulsed laser^a with the "high" inflammatory Fr A" (38,386 Hz), because only this laser unit transports sufficient energy into the depth of the tissue in an acceptable treatment time without damaging overlying tissue layers. The applied laser energy is dependent on the pulse Fr between 1-10 joules per localization^{11,12}. The difference between the various species is of less importance, however, a wound can be deeper in a horse than a dog and the treatment of an organ needs more time in large animals than in small animals.

A continuous wave laser is used solely by the author for the local treatment of eye diseases such as equine recurrent uveitis, (ERU), corneal injuries, corneal ulcers etc. The applied energy in these conditions is about 1 joule, which is an equivalent for a 100mW continuous wave laser therapy^b for about 20 sec. In contrast to the body tissues, the eye is optically transmissive and the cellular need for laser energy is at the surface of this transparent medium. Here, high wattage is not needed as it may penetrate too deep. The pulse laser with high pulse powers would virtually "shoot into the void" of the eye.

Both continuous wave and pulsed laser units are equally effective for laser therapy of acupuncture points as long as various resonance frequencies are available for selection. For optimum treatment of an acupuncture point, regardless of the type of laser (100mW continuous wave or impulse laser 90W), the treatment time is about 20 to 30 sec. The continuous wave laser emits 1 Joule (100mW), the pulse laser, depending on the therapy Fr about 1-10 joules.

Laser acupuncture techniques

Laser acupuncture differs from pure LLLT in that additionally to the local effects of laser use, the clinician is providing the disease treating benefits of acupuncture. A few very effective acupuncture points, which are easy to use are presented (Table 3). These are acupoints used regularly for some common conditions⁵. Every experienced acupuncturist can combine LLLT with any acupuncture treatment concept that one has in mind, even if the acupoints are treated by a needle or by the laser with the appropriate resonance Fr.

The laser should always be placed directly on the skin of the irradiated area, so that as little energy as possible

is lost. The acupuncture points should be treated on both sides of the body. Local Laser Therapy, or the topical (local) irradiation of the diseased tissue varies depending on the size or volume. According to the depth of the location of the disease and according to the type of tissue and the nature of the pathological process, Fr and applied energy have to be adapted to the body's needs. The same is true in the case of local treatment of organs (Table 4).

Handling Precautions for Class 3B and Class 4 Lasers

Although, in the author's veterinary clinic, there have been no accidents and there appears to be very little accident potential to the eyes with Class 3B pulsed lasers, there are certain prescribed safety regulations for

Table 3: Acupoints, their indications, treatment time and strength, wavelength and frequencies of the impulse laser used in the case studies

Acupoints	TCVM indication	PCLAC indication	Laser Strength (Watt)	Laser wavelength (nm)	Pulse Frequency (Herz)	Treatment time (seconds)
KID-7	Tonifying point KID	Kidney point	90	904	Rf. KID (611)	20
LI-4	Master pain relief	Thalamus point	90	904	Rf. LI (553)	20
LU-9	Tonifying point LU	Blood perfusion	90	904	Rf. LU (824)	20
LIV-13	LIV	Pituitary gland	90	904	Rf. LIV (442)	20
LIV-8	Tonifying point LIV	Liver point	90	904	Rf. LIV (442)	20
TH-5	Luo- TH and opening point	Thymus point	90	904	Rf. TH (732)	20
BL-23	Back-Shu point KID, Yang aspect KID	Back-Shu point, Sympathetic aspect KID	90	904	Nogier freq. C (1168)	20-40
BL-18	Back-Shu point LIV, Yang aspect LIV	Back-Shu point, Sympathetic aspect LIV	90	904	Nogier freq. C (1168)	20-40
BL-1	Local Eye	Local Eye	90	904	Nogier freq. A'' (37376)	20
ST-1	Local Eye	Local Eye	90	904	Nogier freq. A'' (37376)	20
TH-23	Local Eye	Local Eye	90	904	Nogier freq. A'' (37376)	20
GB-1	Local Eye	Auricular point of the eye	90	904	Nogier freq. A'' (37376)	20
SP-2	Tonifying point SP	Anabolic master point	90	904	Rf. SP (702)	20
SP-4	Luo- SP and opening point	Interferon	90	904	Rf. SP (702)	20
GB-41	Opening point GB	Prostaglandin E1 point	90	904	Rf. GB (583)	20
SI-3	Opening point SI	Master point spasm	90	904	Rf. SI (791)	20

nm = nanometers, hertz = cycles per second; Nf. = Nogier frequency, Rf. = Reininger (meridian) frequency, PCLAC = Pulse Controlled Laser Acupuncture Concept

handling lasers, which naturally should be followed. In all lasers recommended by the author: Laserpen^b (70/100mW cw laser) to treat the eye and Physiolaser^a (90W pulsed lasers) for tissue therapy, the emitted laser beams have a divergence of about 10°. This means that no focused laser beam can hit the eye, where it can cause injury. Still, wearing laser safety goggles is mandatory and people present in the room should wear such glasses. The treatment room should be free of mirrors and reflective metal surfaces to prevent any conceivable damage to the eyes of owners and staff.

In the topical treatment of tissue or laser acupuncture using Class 3B cw laser or Class 3B impulse laser with unfocused laser beam, there is no risk of skin burns. In patients with strongly pigmented skin, particularly after prolonged laser exposure at high frequencies (Nogier E ‘, F’, G ‘, A’’, Bahr 5, 6 and 7’), if the animal is showing some discomfort; the treatment of that particular point is interrupted for a few seconds, until the animal is comfortable and then treatment with the desired energy is resumed. Here too, even at very intensive therapy of infected wounds or disturbing foci, throughout the experience period of the author, no adverse effects or burns have occurred.

Class 4 lasers should have very strict precautions, especially regarding the protection of the eyes. The risk of skin and tissue burns are higher with these lasers, since much of the laser energy is absorbed in the outer skin. The author is aware of a number of cases of significant burns to the backs of horses with these units. Such events contribute neither to treatment benefit nor to a better acceptance of laser therapy.

Laser Use in Clinical Cases

Wound treatment (Acute or Surgical Wound)

During the treatment of open wounds, the laser should always be wrapped (plastic), to both protect the wound against contamination from environmental bacteria and to protect the laser from contamination by wound bacteria. If possible, during wound treatment, the laser should be placed directly on or inside the wound

(even to a depth of 1-2 cm). To promote wound healing in non-infected wounds, treating the wound edges for 10 sec/cm with Nogier Fr B is sufficient. To prevent infection, the wound depth can be treated for an additional 10 sec with Fr A’’. In addition to local laser therapy, the acupoint, SP-2 (anabolic master point wound healing/tissue building) is treated for approximately 20 seconds (100mW cw or 90W pulsed laser). This significantly improves wound healing and avoids secondary infection of surgical wounds which provides fast and stable wound closure and dehiscence can be reliably avoided. Tissue damage from laser therapy with these lasers is unknown^{2,6}

Wound treatment (Infected Wounds)

Laser acupuncture, in the author’s experience, is the treatment of choice for infected wounds; no matter whether it is an acute infection, a contaminated wound associated with trauma or a 6 month old castration wound with antibiotic resistance and revision surgery failure.⁸ Laser acupuncture and LLLT is extremely reliable, even in hopeless cases. The treatment consists of local treatment of the wound with Fr A’’ with an applied amount of energy of 10-50 joules, depending on the size and the depth of the wound. This corresponds to a treatment time of about 1-5 minutes with a 90W impulse laser. The major acupuncture points to use are SP-2 (anabolic master point) to promote wound healing, SP-4 (interferon point) and TH-5 (thymus point) for 20-30 sec with the corresponding Reninger (Rf) Meridian frequencies to fight infection. Depending on the severity of the infection, the wound must be treated daily to 2 times a week until complete healing. The treatment intervals can be adapted to the healing process.

Case example: MRSA (Methicillin Resistant Staphylococcus Aureus) infection after castration of a 2-year-old Bernese Mountain dog

A 2-year-old Bernese Mountain dog was presented with a 15-20 cm purulent swelling of a castration wound. The dog had been neutered 4 months previously. Within a few days following surgery, a fistulous wound was noted.

Table 4: Laser Treatment Times and Energy Dose*

Location	Energy Dose	Treatment Time
Acupuncture Point	0.5-1 Joule	20 sec
Superficial Wound	2-3 Joule/cm ²	20-40 sec
Deeper Wound Infected Wound	6-10 Joule/cm ²	30-60 sec
Joint	4-16 Joule/location	30-120 sec
Tendon	4-16 Joule/location	30-120 sec
Spinal Cord	4-16 Joule/location	30-120 sec
Disturbing Focus-Scars	4-8 Joule/location	30-60 sec
Disturbing Focus-Teeth	8-20 Joule/location	60-120 sec

*Using Class 3B, 90W, Pulsed Laser (Physiolaser)

Methicillin Resistant Staphylococcus Aureus was cultured from the tract. Antibiotic therapy with various antibiotic cocktails, anti-inflammatories, wound drains along with additional surgical procedures for 4 months proved ineffective in controlling the infection. The markedly swollen, fluctuating wound was very painful, severely reddened and was characterized by an erysipelatos-like skin discoloration (Figure 5). The treatment was simple. In addition to 3 minutes local laser therapy^a with Fr A ‘‘ (37,376 Hz); acupoints for immune stimulation were treated for 30 sec: TH-5 and SP-4 with the corresponding Rf Meridian frequencies. This treatment was continued by the owner with an identical laser at home every day using the same protocol. After 1 week, the swelling was significantly reduced with the wound demonstrating less pain and reddening. The erysipelous discoloration had almost disappeared. After another week of the same therapy, the infection was healed. At a clinical recheck 14 days later, the surgical scar was barely visible (Figure 6).

Muscle and tendon injuries

Laser acupuncture and LLLT is particularly effective in the treatment of muscle and tendon injuries. The problem with acute and chronic tendonitis of the horse, and ligament and muscle injuries in dogs and horses is that damaged tendons and muscle fibers are repaired by connective tissue. This dense, firm connective tissue is inelastic and therefore extremely vulnerable to re-injury. The elastic and muscle fibers cannot penetrate the scarred area to a sufficient extent to restore the original structure and function of the tendon or muscle.⁶ Low Level Laser

Therapy (LLLT) plays a fundamental role because it represents, in the author’s experience the best way to loosen and restructure the scarred dense connective tissue, so that normal collagen fibers can be incorporated.¹⁵

Case example: Complete rupture of the superficial flexor tendon in a Trakehner mare

An 18 year old Trakehner mare was presented with a complete rupture of the superficial digital flexor tendon. Examination of the open wound revealed a tendon rupture with the two ends of the tendon at a distance of about 6 cm. The wound was too contaminated for surgical treatment, therefore, laser acupuncture was preferred because of the excellent antibacterial, wound and tendon healing effects.

Daily treatment consisted of intense irradiation of the entire wound surface, particularly the tendon ends with the anti-inflammatory laser Fr Nogier A’’ for 5 minutes with a 5 x 30W pulsed multicluster probe^a (Figure 7). Acupuncture points to promote wound healing (SP-2, with Reininger Fr for the Spleen) and TH-5 and SP-4 (to remove necrotic tissue and control inflammation) were also treated daily with Fr Bahr 5. The wound was cleaned daily with a lavage fluid (2g Rivanol® +50ml Echinacea tincture, 50 ml Arnica tincture and 50 ml Calendula tincture per liter) and kept under bandage. Except for a tetanus booster, no further therapy was carried out with antibiotics or anti-inflammatory drugs. Despite intensive irradiation with anti-inflammatory Fr A’’, initial swelling of the surrounding tissue and granulation tissue formation could not completely be suppressed. Two weeks after starting laser acupuncture, a large wound and



Figure 5: A 2-year-old Bernese Mountain dog presented with a 15-20 cm purulent swelling of a castration wound. The dog had been neutered 4 months previously. Within a few days following surgery, a fistulous wound was noted. Methicillin Resistant Staphylococcus Aureus was cultured from the tract. The markedly swollen, fluctuating wound was painful, severely reddened and was characterized by an erysipelatos-like skin discoloration. This photograph taken after the 2nd revision surgery before laser treatment.



Figure 6: The 2-year Bernese Mountain dog at clinical recheck 14 days after laser acupuncture and LLLT. The dog is culture negative for MRSA and the surgical scar is barely visible.

swelling (8 cm diameter) was still present.

The horse had very little pain during therapy so treatment was continued at the author's clinic in 2 day intervals with slow but steady progress noted. After a total of 8 weeks, the external wound was closed and the mare was dismissed. Further treatment was continued by the owner with the same treatment protocol for another 6 weeks until healing was completed. The healed tendon continued to improve to the point that almost normal physiological strength was achieved (Figure 8). The mare was slowly started under saddle at a walk and as improvement and comfort continued, she slowly returned to former activities.

Equine laminitis

Laser acupuncture can be an effective treatment of laminitis in all stages and degrees of rotation¹⁰. In these cases, the synergism of the acupuncture effect and local laser therapy is particularly clear. The laser locally improves the microcirculation and peroxide clearance which reduces pain and inflammation quickly^{9,7}. There is usually a visible improvement in gait within hours. Local treatment is applied with alternating Nogier Fr A'' and Fr B. This option can automatically be selected in the Physiolasera or the change can be made manually during treatment in 10-second intervals between the two frequencies. The central part of the front hoof wall is mainly treated (area of 3x5 cm), Figure 9. One can also use a 5 x 60w multi-cluster probe^a with 5 laser diodes, which considerably shortens the individual duration of



Figures 7 and 8: An 18 year old Trakehner mare presented with complete rupture of the superficial digital flexor tendon. Examination of the open wound revealed a tendon rupture with a 6 cm distance between the two ends of the tendon. The wound was too contaminated for surgical treatment, therefore, laser acupuncture was preferred because of the excellent antibacterial, wound and tendon healing effects. Tendon wound at the beginning of therapy (left photo) and at the end of laser acupuncture and LLLT (right photo).



Figure 9: Modern impulse laser penetrating the hoof wall in a horse with laminitis. The cast has drilled holes of 8mm each for placing the laser tip directly on the hoof wall.

therapy. If there is a risk of sloughing hoof, the affected part of the coronary band should be intensively treated locally with Fr A'' and B'.

Acupuncture points to use in these cases are LIV-8 (Rf Meridian Fr Liver), SP-2 (Rf Meridian Fr Spleen/pancreas), KID-7 (Rf Meridian Fr Kidney) and GB-41 (Rf Meridian Fr Gall Bladder) for 20 sec each on both sides. In the case of metabolic syndrome or Cushing Disease, treat the pituitary locally between the TMJ (temporal mandibular Joint) and ear with Rf Liver Fr and A'' for 1 minute each on both sides and the acupoint LIV-13 for 20 sec.

Case Example: Severe acute laminitis with coffin bone rotation in an 11-year-old Trakehner mare

An 11- year-old Trakehner mare developed severe acute laminitis at the beginning of the grazing season. Despite intensive therapy for 1 week in a veterinary hospital, there was significant rotation of the left front coffin bone (confirmed by radiographs) (Figure 10). The mare was severely lame on both front feet with non-weight bearing lameness on the left front (Figure 12). Treatment protocol included 4 treatments at intervals of 3 to 4 days with laser acupuncture and LLLT at the author's clinic.

Local treatment of the lamina to improve circulation and reduce inflammation was performed with a multi-cluster probe^a. Additionally, acupuncture points to support Liver and Kidney function (LIV-8, KID-7) and GB-41 (prostaglandin point) for pain and inflammation were used. After 14 days, the mare's lameness was significantly reduced and she was able to trot. The horse was released to go home and treated by the owner with the same treatment protocol for the next 2 weeks. Expert farrier care of the hooves addressed abnormal growth by trimming the left toe as much as possible frequently. Four weeks after laser acupuncture was started, the mare was sound and within 6 more weeks, she was put into full training. After a total of 4 months, radiographs were taken again and showed that the rotation of the coffin bone was almost completely resolved and the newly formed hoof wall oriented almost parallel to the coffin bone again (Figures 11 and 13). The mare is performing successfully in dressage now and at 1 year recheck, without any further treatment, is sound.

Back pain, spinal disorders and spondylosis

The almost ubiquitous back pain in horses and spondylosis in dogs are predominately associated with



Figure 10 and 11: An 11- year-old Trakehner mare developed severe acute laminitis at the beginning of the grazing season. Hoof conformation before (left photo) and after laser acupuncture (right photo).



Figure 12 and 13: Same 11 year old Trakehner with significant rotation of the left front coffin bone before start of laser therapy (confirmed by radiographs, photo on left). Photo on right of radiograph of the left hoof after laser acupuncture.

small displacements of the facet joints of focal sections of the spine (vertebra blockages). These blockages can evoke nerve root irritation in the affected segment which stimulates the “segment regulatory complex” inside the posterior horn of the spinal cord.¹⁶ This creates permanent muscle contraction, which locks the vertebral bodies in a position of misalignment. It also leads to contraction of blood vessels and thereby reduced blood flow resulting in acidosis. Here arises the disastrous vicious circle of pain, duration of contraction, malnutrition and acidosis, from which the patient cannot recover. The outcome in acute cases can be “tying up” in horses and in chronic cases if the spasm and the pain becomes permanent, the syndrome of “kissing spines” occurs. In dogs, a similar genesis results in disc disease and spondylosis.

A very simple, but nevertheless very effective treatment is the use of laser acupuncture.^{17,18} In the horse, simple palpation of the back for pressure sensitive areas identifies painful areas. The horse will clearly show where the pain is localized.¹⁹ With the use of the laser, a clinician now has 4 excellent treatment effects at once. First, local LLLT, very effectively provides direct local energy (Qi / ATP input) which the energy insufficient muscle urgently needs to relax and, second, at the same time, the laser light improves microcirculation in the contracted blood vessels.^{1,2,3,4,8} This is accomplished by application of the laser on both sides of the vertebral blockage with Fr Nogier C, both dog and horse, about 1 minute per location. The third effect of the laser is acupuncture stimulus of the back-Shu point which acts directly on the “Segment Regulatory complex” and immediately interrupts the vicious circle and reduces muscle tone.¹⁶ The fourth influence of the laser is calming the irritable state of the nerve root. The optimal therapeutic Fr in this case is Fr Nogier E with affinity to nerve tissue, which is applied for 30 sec. Thus, stimulation by the laser performs 4 synergistic treatments at the same time.

Acupuncture points for support are LI-4 (master pain relief point) 20 sec with Fr LI (Reininger) and GB-41 (master point rheumatic pain) 20 sec with Fr Bahr 5. With this simple therapy more than 1000 horses and dogs have been successfully treated by the author.^{17,18} In addition, an experienced acupuncturist can add any additional complimentary acupuncture points, depending on the needs of the patient and TCVM pattern diagnosis.

Acute and chronic lameness

If the exact inciting area of a lameness is known, a simple treatment of local laser therapy and acupuncture is possible. This involves both acute lameness as sprains or contusions and chronic lameness, where a combination of muscle and tendon disorders, insertion-desmopathy and joint irritation have led to osteoarthritis. In all lameness, consideration should be from the perspective of acupuncture as well as from the perspective of physiology. The close connection between the above mentioned nerve

root irritations and the segment regulatory complex may form a pathologic tonus of muscles and tendons which secondarily harms the peripheral joints. This means that assessment should also consider underlying back and even neck issues when treating a lameness. A similar treatment as mentioned above can also be used for treatment. The local joint pain and inflammation is treated with Nogier Fr C’ and Nogier A” in combination. Modern lasers offer the setting of alternating frequencies, or one can treat with each of the two frequencies sequentially, each 30 sec with Fr C and 15-20 sec with Fr A”. Supporting acupuncture points are the same as in back problems, GB-41 and LI-4. Any acupuncture treatment can be applied additionally to this simple concept depending on a clinician’s own experience as to what has worked well before.

Eye diseases

Treatment of eye diseases is another area where there is clear benefit associated with the use of laser acupuncture. Regularly treated eye diseases are corneal injuries and corneal ulcers, as well as immunologic eye diseases, such as equine recurrent uveitis. For local treatment of the eye, a 70mW cw laser^b (Figure 2) is used instead of the impulse laser. This is in contrast to all other local laser treatment. In corneal ulcer or corneal injury, the beam path is applied strictly tangentially to the injured areas of the cornea. In acute inflammation, Nogier Fr A is used for 30 seconds; for regeneration, such as corneal injuries, Nogier Fr B is used.

If the inflammatory process also includes the interior of the eye, as in equine recurrent uveitis, the laser beam can also be applied for 20-30 seconds up to an angle of approximately 45° to the inner eye. It is important to avoid irradiation of the retina directly. No adverse side-effect from treatment of the eye has been observed, however it is prudent to be cautious.

There are 4 local acupoints around the eye, BL-1, ST-1, TH-23 and GB-1. GB-1 is identical to the eye point of ear acupuncture. Other points are LIV-8, GB-41 and TH-5. All are treated for about 20-30 sec with the corresponding Rf meridian Fr. For this purpose, both the pulse laser^a and the continuous wave laser^b may be used. The treatment time for both lasers is 20-30 sec.

Case Example: Perforating corneal injury in a pony gelding

A pony gelding had his eye pierced by a pitchfork tip. The cornea was completely perforated with a lesion diameter of 7mm. The animal was pretreated carefully by another vet for over 3 weeks with general and local antibiotics, eye ointment and an eye bandage. Medication for pain reduction included 15ml Novalgin®^c solution applied daily. Thereafter, laser acupuncture was started. Ophthalmic examination revealed a very painful and light-sensitive eye with a deep corneal ulcer. The cornea was opaque, swollen, had a purulent discharge and a distinct

reddish/yellow-red purulent exudate in the anterior chamber (Figure 14).

The following points were treated with the impulse laser^a for 30 sec each with Fr A' and A'': ST-1, GB-1, BL-1, TH-23. Acupoints LIV-8, TH-5, GB-41 were treated with the Rf Meridian frequencies. In addition, the ulcer was treated locally with direct but slightly tangential continuous wave laser^b (Fr A) for 30 sec. The medical pretreatment was continued unchanged in this case. At intervals of 4-5 days, the eye was treated by the author with the treatment protocol just described, and between sessions in the same manner by the owners. At the first clinical recheck after 4 days, there was an incipient organization of the ulcer with marked pannus and absorption of the reddish secretion in the anterior chamber. The pain was significantly decreased and the pony more readily tolerated the application of ophthalmic ointment. After another 4 days, further improvement was obvious and antibiotic treatment was discontinued. After 18 days of treatment, following the first acupuncture treatment, the eye showed complete regeneration with no residual dysfunction (Figure 15). The original perforation was now a white, non-reactive scar, which did not create any visual limitations for the pony.

Disturbing foci in scars and teeth

Another important application of laser treatment is elimination of disturbing foci in scars and teeth. In the author's experience, these foci often play an essential role in development of chronic disease.^{5,11} With their discovery and treatment, one can greatly enhance the healing process of some diseases and provide a good chance for resolution.

A disturbing focus mainly arises from larger scars, especially when a delayed wound healing or drainage preceded the chronic disease. Further, particularly persistent disturbing foci can include infected tooth roots or non-painful inflammatory processes which are difficult to detect. In the treatment of all these disturbance foci, laser acupuncture offers impressive opportunities. The local therapy is done with Nogier Fr A'' for 1 - 3 minutes

per localization (15-60 joules). Beside Fr A'' we have a second kind of special teeth disturbing foci which are treated by fr. Bahr 7 (38,386 Hz.) An effective acupuncture method to support disturbing focus treatment is the acupoint TH-5, an important immunologically effective point that promotes the healing of granulation tissue in the focal disturbance. A very pleasant side effect is that the scars almost completely regress after a few treatments.

Conclusion

Acupuncture and laser therapy are two separate therapeutic modalities that when combined have a unique synergism. In the author's 28 year experience with several thousand animals, the combination of these therapies as laser acupuncture is an extremely effective treatment option for almost all diseases found in horses and dogs. With the use of suitable impulse lasers, this therapy is capable of exerting profound anti-inflammatory and antibacterial effects along with the ability to promote healing in devitalized tissue. The local effect of the laser with energy supplied in the form of ATP is excellently supplemented by an autonomous regulation of the immune system and stimulation of organ functions by acupuncture. It is hoped that more veterinarians, particularly those with acupuncture expertise, will use this truly versatile therapy. It provides another tool in the clinician's tool box and in the author's experience is able to rescue cases that were thought to be hopeless. This "holistic treatment" not only treats a focal problem in the back, hip or tendon but endeavors to treat the whole animal.

FOOTNOTES

- a. The Physiolaser Olympic; 90 W/904nm, super pulsed laser. Reimers & Jansenn, 14057, Berlin, Germany
- b. Laserpen; 70 mW/785nm, continuous wave laser. Reimers & Jansenn, 14057, Berlin, Germany
- c. Novalgin® Sanofi-Aventis Deutschland GmbH
Industriepark Höchst / Gebäude K607
65926 Frankfurt am Main

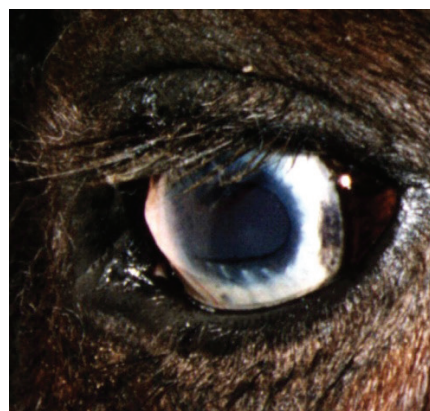


Figure 14 and 15: Panophtalmia in pony gelding after perforation of cornea (pitchfork-injury) and conventional therapy for 3 weeks, before laser acupuncture (left photo) and after 18 days of laser acupuncture (right photo).

REFERENCES

1. Hamblin MR, Demidova TN. Mechanisms of low level light therapy, Proc. SPIE. 2006: 6140, doi: 10.1117/12.646294.
2. Karu TI. Photobiological Fundamentals of Low-Power Laser Therapy. IEEE Journal of Quantum Electronics QE-23, 1987: 1703-1717.
3. Warnke, U. Der Dioden-Laser, Deutsches Ärzteblatt, 44, 1987: 2941-2944
4. Warnke, U. Wie Licht-Energie zu Zell-Energie wird. Ärztliche Praxis Jahrg. 97, 1987: 3039-3040.
5. Petermann, U. The Components of the Pulse Controlled Laser Acupuncture, PCLAC, AJTCVM 2012; 7 (1): 57-67.
6. Mester E. Jassagi-Nagy, E. Experimentelle Untersuchungen über die Wirkung von Laserstrahlen auf die Wundheilung. Z. Exper. Chirurgie 1969: 2,94-101.
7. Karu T. et al. Suppression of human blood chemiluminescence by
8. diode laser irradiation. Laser Therapy 5, 1993: 103-109.
9. Petermann, U. (2015) Wound Infection Combination of Laser Acupuncture and Low Level Laser Therapy for Treatment of Non-healing and Infected Wounds, AJTCVM 2015; 10 (2): 33-42.
10. Skobelkin O.K. et al. Blood Microcirculation under Laser Physio-and Reflexotherapy in Patients with lesions in Vessels of Low Extremities. Laser Therapy 1990: 69-77.
11. Petermann, U. Comparison of Pre- and Post-treatment Pain Scores of Twenty One Horse with Laminitis Treated with Acupoint and Topical Low Level Impulse Laser Therapy, AJTCVM 2011; 6 (1): 13-25.
12. Petermann, U. Pulse Controlled Laser Acupuncture Concept (PCLAC), Textbook for controlled acupuncture, 2007; self-published, www.akupunkturtierarzt.de.
13. Nogier, P. F.M. Lehrbuch der Auriculotherapie Maisonneuve; 1981, Sainte Ruffine.
14. Bahr, F., Strittmatter, B. Das große Buch der Ohrakupunktur, 2010; Hippokrates Verlag, Stuttgart.
15. Reininger, M. Die meridianspezifischen Laser-Frequenzen nach Reiniger EAA Expertenkongress, Der Akupunkturarzt 4; 2002: 11-15.
16. Petermann, U. Treatment of 29 Cases of Acute and Chronic Equine Tendonitis with Local Laser Therapy and Laser Acupuncture, AJTCVM 2016; 11, (2): 43-51.
17. Bergsmann, O. Die biokybernetische Wirkung der Akupunktur im klinischen Versuch, Dtsch. Ztschr. f. Akup. 1977; 5 :131ff.
18. Petermann, U. Behandlung von BWS- und LWS-Beschwerden beim Pferd mit Ohrakupunktur. collegium veterinarium; 1989: 20/91-93.
19. Petermann, U. Laser Acupuncture in the Treatment of Chronic Back Pain in Horses, Procc. of 28th IVAS 2001 World Congress, Liuhe Hawaii, USA: 81-88.