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## **Laser Acupuncture Treatment of Equine Cushing's Syndrome** Uwe Peterman DVM

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### **ABSTRACT**

Equine Cushing's syndrome (ECS) or pituitary pars intermedia dysfunction (PPID) is a chronic progressive pituitary disease that occurs almost exclusively in older horses and ponies. Management of this chronic disease can be difficult, particularly in individuals that don't respond to the medication, pergolide, which is one of the only effective treatments at this time. The use of low-level impulse lasers (LLL) to treat ECS are introduced in this paper. They have been applied focally to stimulate acupoints (laser acupuncture) and topically over wounds, joints and other tissues to increase circulation and promote healing. Laser acupuncture therapy is an effective useful treatment method which is relatively easy to learn and apply and is an extremely effective therapy for numerous, chronic, degenerative diseases. The cases presented in this paper are a small sample of well over 30 ECS patients which have been successfully treated with laser acupuncture. Treatment protocols are presented for optimum laser acupuncture therapy along with a review of laser mechanism of action and appropriate selection. Treatment usually takes approximately 6 weeks up to 3 months and it appears that even horses that have had chronic disease for years can still have positive clinical outcomes.

**Key words:** 90W/904nm pulsed laser, acupuncture, Cushing's syndrome, equine, pituitary pars intermedia dysfunction

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### **ABBREVIATIONS**

<b>Bfr</b>	Bahr's laser frequency (usually followed by a number, e.g. Bfr-1)
<b>ECS</b>	Equine Cushing's syndrome
<b>Fr</b>	Frequency of light pulses
<b>Hz</b>	Hertz or cycles per second
<b>LLL</b>	Low level impulse laser
<b>LLLT</b>	Low level laser therapy
<b>mW</b>	Milliwatt
<b>Nfr</b>	Nogier's laser frequency (usually followed by a letter, e.g. Nfr-A')
<b>Nm</b>	Nanometers
<b>Ns</b>	Nanoseconds
<b>PPID</b>	Pituitary pars intermedia dysfunction
<b>RAC</b>	Reflex auriculo cardiacal
<b>Rfr</b>	Reininger's laser frequency (followed by a Channel abbreviation, Rfr-HT)
<b>TCVM</b>	Traditional Chinese veterinary medicine
<b>VAS</b>	Vascular autonomic signal
<b>W</b>	Watt

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Equine Cushing's syndrome (ECS) is a chronic, progressive pituitary disease that occurs almost exclusively in older horses and ponies over 15 years of age. The terms ECS, equine Cushing's disease, hyperadrenocorticism and pituitary pars intermedia dysfunction (PPID) are all used to describe horses with this chronically progressive incurable syndrome.<sup>1</sup> The disorder is related to a slow neurodegenerative process in which dopaminergic neurons sustain oxidative damage which results in neuron loss and reduced dopamine (inhibitory neurotransmitter) synthesis.<sup>2</sup> The pars intermedia cells react to the lack of dopamine with excessive growth (regional hyperplasia), which over time can progress to neoplasia. Adenomas of the pars intermedia in horses often extend out of the sella turcica and expand dorsally compressing the hypothalamus which is the primary center for homeostatic regulation (body temperature, appetite, cyclic shedding of hair).<sup>3</sup> The expansion of this area leads to excess ACTH secretion associated with increased plasma cortisol level which lacks normal diurnal rhythm and is unresponsive to dexamethasone administration.<sup>4</sup>

Clinical signs associated with these hormonal changes include haircoat abnormalities (thick, long winter

hair coat, delayed spring shedding, long summer coat with curls), emaciation, loss of muscle mass (especially along the topline), polyuria, polydipsia, intermittent hyperpyrexia, lethargy, suppressed immune system (frequent/persistent infections) and hoof disease (e.g. abscesses and laminitis in unusual seasons).<sup>1,5</sup>

Even if this chronic disease is not curable, it can be managed long term with conventional treatment by the use of the dopamine agonist, pergolide.<sup>1,2,4</sup> Although improvement of clinical signs are generally associated with the use of this pharmaceutical, there can be decreased efficacy over time or complete lack of response in some animals. Less well known but of benefit is the use of an alternative treatment, chaste tree (*Vitex agnus-castus*) which has a dopamine-agonizing effect on the pituitary gland.<sup>6</sup>

The etiology of this syndrome from a traditional Chinese veterinary medicine (TCVM) perspective usually starts with the Excess condition of Liver *Qi* Stagnation which causes loss of the Blood regulatory function. This leads to Heat, Damp and Blood Stasis. The chronic Heat, Phlegm, *Qi* and Blood Stasis allows for the formation of a pituitary mass which consumes *Qi* and *Yin*. Chronic cortisol release by the pituitary tumor further consumes *Qi* and *Yin*. There are several TCVM patterns to consider treating depending on the TCVM exam: Liver *Qi* Stagnation (Liver also can overact on Spleen with further accumulation of Damp-Phlegm and *Qi* Deficiency), Spleen *Qi* Deficiency with Damp Heat (some laminitis horses), Kidney *Qi* and *Yin* Deficiency, Kidney *Yang* Deficiency.<sup>7</sup>

### **Acupuncture and Laser Theory Acupuncture**

Acupuncture points are small areas of reduced electrical resistance near the surface of the body consisting of a high concentration of free nerve endings and blood vessels with the fascia and muscles.<sup>8</sup> It stimulates nerves to evoke autonomic reflexes and neurohumoral changes via higher brain centers to restore homeostasis of the body.<sup>8</sup> Acupoints may be stimulated with pressure, dry needles, electricity, injections of substances, implantation of substances, moxa and lasers. Laser acupuncture treatment is based on traditional acupuncture point selection combined in some cases with auricular acupuncture and local laser therapy of damaged tissues. It has some advantages over dry needle acupuncture in that it is usually painless and there is no need to mechanically penetrate the skin.<sup>8</sup>

There are in-depth investigations into the mechanism of action of the infrared laser.<sup>9-12</sup> Light absorption directly into cells takes place by means of a flavoprotein-metal-redox-system or “antenna pigment” which is an important link in the mitochondria respiratory chain. The absorbed laser photons are converted directly into cell energy here.<sup>13,14</sup> This energy is generated directly via the citric acid cycle and stimulates adenosine triphosphate (ATP) production. Laser radiation can create increased ATP production at levels of up to 150%.<sup>12</sup> An excessive boost of energy in the nerve cells of the acupuncture point causes hyperpolarization and, like a needle prick, provokes an action potential.

In addition to acupoint stimulation, the increased ATP production contributes to repair/rebuilding of diseased cells which require high levels of energy to absorb inflammatory secretions and synthesize new structures to return to normal function. Laser light also has the important therapeutic property to improve blood perfusion.<sup>15</sup> The stimulation of acupuncture points by laser light could be demonstrated in a double-blind study with the help of functional magnetic resonance imaging (fMRI).<sup>16</sup> Several studies confirm a radiation dose-response relationship in that doses too small have no positive effect, but with increasing dose there is a therapeutic range which is lost again (tissue injury) at doses that are too high. In general, acupoints need a treatment duration of 15-30 seconds (0.5-1 joule) when a 90W, 904 nm, pulse laser is used.<sup>13</sup>

### **Laser Selection: Wavelength, Power/Energy Output and Resonance Frequency**

Low level impulse laser (LLL) light at specific wavelengths, power/energy output (mW/W), duration (ns) and resonance frequencies (Hz) can be applied focally over acupoints for laser acupuncture.<sup>13</sup> Care must be taken to distinguish between the different resonance frequencies (Fr) of the laser, the number of laser pulses sent out per sec (Hz), and the wavelength of the laser light used, as variations in these settings will affect treatment success.

Lasers used for acupuncture and local tissue therapy are diode lasers and have the great advantage that they are very compact. It is important to differentiate between types of lasers. Medical laser devices most commonly work with wavelengths in the near-infrared to infrared range (600 - 1000 nm). The energy output of these devices is between 30 and 500 mW (Laser Class 3b) and very powerful lasers up to 8 W (Laser Class 4).<sup>17</sup> Two types of lasers are used based on 1) continuous light waves and 2) pulsing waves. On the one hand, the continuous-wave lasers emit continuous laser light, nevertheless with considerable heating of the skin surface if the laser is not kept in constant motion. The second type of laser is the pulse laser, in which instead of continuous energy delivery, the laser energy is delivered in the form of individual light pulses of very high intensity. The individual light pulses can have a power of up to 90 W, which means they are about 1000 times stronger than a Class 3b continuous wave laser; however, only pulses of very short duration (200 nanoseconds) are emitted. Although the tissue penetration of the laser light in the pulse lasers is much higher due to high power, the short duration of the light flashes insures no thermal or coagulating effect in the tissue occurs.<sup>16</sup>

In addition to energy output (mW/W), another important criterion for stimulation of acupuncture points are the resonance frequencies. In order to achieve an optimal resonance for different tissue types, the continuous

laser beam can be modulated to specific resonance frequencies. In the pulsed laser, the resonance frequency is achieved by the pulse frequency of the light pulses (Figure 1). There are now three important series of resonance frequencies, according to Nogier, Bahr and Reininger (Table 1).

Dr Nogier, a noted French neurologist and a master of Chinese pulse diagnosis, noticed distinct changes in the qualities of the radial pulses of his patients when acupoints were stimulated with low level laser light at different frequencies (light impulses per second).<sup>18</sup> He initially called this pulse change “reflex auriculo cardiacal” (RAC) but later changed the name to vascular autonomic sign (VAS). He realized that the pulse changes were associated with stimulation of sensory nerves near the active acupoint which in turn stimulated sympathetic nerves to blood vessels which altered the pulse.<sup>18</sup> Using the VAS pulse changes to determine the most effective frequency of light pulses, he developed a range of treatment/diagnostic resonance frequencies (Nogier frequencies, Nfr) that proved effective for acupoint stimulation and other clinical applications. These resonance frequencies are mainly related to certain tissue conditions. For example, the Nogier frequency A’ or A” (Nfr-A’/Nfr-A”) are used for acute inflammation, frequency C’ (Nfr-C’) for musculoskeletal disease and frequency E’ (Nfr-E’) affects the nerve tissue (Table 1).<sup>19</sup> It is important to mention that the energy output of the pulse laser, measured in joules (J), depends very much on the pulse frequency. While Nogier frequency A’ (292 Hz) only emits a few energy pulses per sec, the high frequency Nogier A” (37376 Hz) has 128 times higher energy output.

Some years later a German physician, Dr Bahr, with the help of the VAS reaction found another very important range of frequencies that were useful for diagnosis and treatment of tissues, acupoints and Channels. His group of frequencies are related more to the autonomic nervous system reaction states (parasympathetic/sympathetic nervous system) and deep versus superficial tissue disease states.<sup>18</sup> Frequency 1 (Bfr-1) is related to the sympathetic nervous system but also affects deep tissue layers and is useful to detect and treat the “deep” point of a disease. Frequency 2 (Bfr-2) has an affinity for the parasympathetic nervous system and also affects the central tissue layer. It is useful to treat hormonal and nervous system disorders.<sup>20</sup> Laser frequency Bfr-3 affects surface tissue layers. The frequencies of Bfr-3 and Bfr-4 affect Channels while Bfr-5 is useful to treat the Cardinal or Opening points of the Eight Extraordinary Channels/Vessels. The Bfr-6 and 7 frequencies affect Governing and Conception Vessel Channels while Bfr-7 frequency also treats abnormal foci in the teeth. Some chronic clinical disorders will rapidly recover after Bfr-7 treatment of the affected teeth.

Also using the acupoint VAS pulse diagnostic system, Dr. Reininger, an Austrian physician and acupuncturist developed a range of laser frequencies that can be used to treat acupoints of specific Channels and organs (Table 1).<sup>10</sup> In Dr. Reininger’s laser frequency system there is a frequency for each organ/Channel system (e.g. Liver acupoints are treated with the Liver Channel frequency, Stomach acupoints with the Stomach Channel frequency) (Table 1). The Reininger frequencies provide more specific and effective stimulation of acupoints than Nogier frequencies such as Nfr-C or Nfr-D. The Reininger frequencies can also be used for topical treatment of organs (e.g. kidneys may be treated with Reininger frequency: Rfr-KID) for the kidneys or the heart with Rfr-HT. The Nogier, Bahr and Reininger frequencies are pre-programmed in many modern LLLT delivery devices and are commonly used by LLLT practitioners for both diagnosis and treatment because they resonate well with acupoints and tissues and have excellent therapeutic effects.<sup>18</sup>

### **Laser Acupuncture Treatment Protocol for Equine Cushing’s Syndrome**

In the period from 2014 to 2018, 26 horses clinically examined and diagnosed at other equine clinics with ECS/PPID were treated with laser acupuncture for the syndrome in the author’s practice. Out of this group, 7 horses had chronic laminitis, all horses had abnormal seasonal changing of their haircoat (poor ability to shed winter haircoat, curly thin hair in summer) and muscle atrophy (especially along topline) despite excellent diet. Other clinical signs included poor performance, apathy, mental depression and laboratory clinical deviations consistent with ECS/PPID.

Vascular autonomic signal (VAS) pulse diagnosis was used to help determine the acupoint prescription at each treatment session, by using the surrogate pulse of the author to determine the location of active acupoints. This diagnostic method finds active acupuncture points through the identification of pulse changes through an autonomic reflex.<sup>18</sup> When noting reactive acupoints in these horses, there is nearly always a reactive LIV-3 (Bahr special frequency<sup>a</sup> “*Qi* Stagnation”) and KID-2 (Bahr special frequency<sup>a</sup> “Selfheal”) reflecting the common TCVM patterns of Liver *Qi* Stagnation and Kidney *Yin* Deficiency, respectively. Using the VAS method of diagnosis, the profound complexity of Cushing’s syndrome (Kidney, Adrenal/ Pituitary/ Thyroid glands, Liver, Pancreas) can be identified. A characteristic finding with VAS controlled acupuncture in all ECS/PPID cases is root inflammation/infection of the 4th premolar (P4) and the first molar (M1) on one side or on both sides of the mandible. The P4 in the upper jaw interferes with acupuncture point GB-1 and the M1 tooth root interferes with acupuncture point GB-41.<sup>16</sup>

The horses were generally stabled at the author’s clinic and treated 5 times a week for 14 days. In order not to suppress the regulatory effect of acupuncture, previous medications were immediately discontinued.<sup>8</sup> The

following acupuncture points were treated with a 90W/904nm pulse laser<sup>a</sup> for 30 seconds (approximately 1 J) per acupoint with varying frequencies: KID-7, the Kidney point (Bfr-1); LIV-8, the Liver point (Bfr-2); SP-2, the pancreas point or anabolic master point ( Bfr-2); KID-3, *Yuan*-source point of the Kidney (Bfr-5); LIV-3, *Yuan*-source point of the Liver (Bahr special, *Qi* movement/master *Qi*, 7695 Hz); and LIV-13, pituitary point (Rfr-LIV) (Table 2, Figure 2). All 6 acupoints are treated in every case.

In addition, both TH-5 (Bfr-5) and GB-41 (Bfr-5) are treated to address the tooth disturbing focus along with local laser therapy for inflammation at the tooth focus. Other disturbing foci found by VAS (i.e. scars), as well as local stimulation of the thyroid gland and the pituitary gland (between the ear and TMJ joint) are treated with Nfr-A” for 1 minute at each site. Lastly, TH-6 (thyroid gland point of auricular acupuncture) and LIV-13 (pituitary point of auricular acupuncture) are treated to finish the therapy. Of interest, the “*Qi* Stagnation” frequency and “Self Heal” frequency on the laser<sup>a</sup> nearly always find a reactive LIV-3 (reflecting Liver *Qi* Stagnation) and KID-2 (Kidney *Yin* Deficiency), respectively in Cushing’s syndrome cases. If these acupoints are active, they are added to the treatment plan: LIV-3 (Bahr Fr- *Qi* movement/master *Qi*) and KID-2 (Bahr Fr-Self- Heal) for 30 sec.

### Clinical Case Example 1

A 27-year-old Friesian gelding diagnosed by abnormal clinical pathology values reflecting insulin dysregulation and severe clinical signs was treated for ECS/PPID with Prascend®<sup>b</sup> (4 mcg/kg) for 3 years. At the time of presentation for acupuncture, after 3 years of this therapy, the horse was lethargic and in very poor condition (body score 3/10). He suffered from a remarkable loss of muscle (particularly the topline) and the back was sunken (Figure 3). The skin was characterized by multifocal hyperkeratotic plaques, a long shaggy hair coat and areas of marked alopecia. The horse also had a severe necrotic hemorrhagic sinusitis of the left side of the head. A large amount of bloody, purulent, foul-smelling secretion (typical smell associated with necrotic bone) was present and draining from the left nostril. This disease had previously been treated for over 1 year with various antibiotic cocktails. Using the laser therapy protocol described previously, the P4 and M1 teeth were identified as trouble spots on both sides of the jaw. The purulent sinusitis present on the left side of the head appeared to be associated with the teeth.

Acupuncture points in general were treated with a 90W/904nm pulsed laser<sup>a</sup> for 30 seconds (approximately 1 J per acupoint) (Figure 2). Treatment of the tooth inflammation was assisted by the addition of TH-5 and GB-41 (30 sec. approximately 1 J per acupoint) and local laser therapy of the teeth inflammatory foci (Nfr-A”, 1 minute, approximately 20 Joules). Local treatment of the thyroid and pituitary glands (Nfr-A”, 1 minute each) was added to the treatment along with LIV-3 and KID-2 (30 secs) which were active acupoints on this horse’s VAS laser scan ( Bfr-*Qi* movement, Bfr-Self Heal, respectively).

The general condition of the patient steadily improved during treatment over the next 6 weeks with 1-2 treatments per week. Improvement was reflected in normalizing skin, haircoat and improved topline as muscle mass returned and blood values normalized. Although there was some improvement in the purulent sinusitis (necrotic pungent smell had abated), the general symptoms of sinusitis continued, therefore, it was decided to extract the M1 tooth.

During the tooth extraction, it was discovered that there was a chronic foreign body root infection (plum core) which had apparently been located at the tooth root between P4 and M1 for years. After extraction, the same laser acupuncture therapy was then continued at home by the owner for 8 weeks. The horse’s clinical condition continued to improve with the tooth root inflammation and sinusitis cured, normal skin, short/shiny normal haircoat and good musculature. The topline filled out and straightened with the horse able to return to being ridden again despite his age (Figure 4).The blood values stayed normal without any further treatment until the horse was 30 years old.

### Clinical Case Example 2

The unwillingness to accept incurable ECS/PPID in her 15-year-old Danish warmblood mare led to this horse being transported from Denmark to the author’s veterinary practice. The horse had been under the owner’s care for 11 years and it was now noted that the usual change of coat (shedding) which began every February, had failed to materialize. When the coat change did not start in mid-March, a blood test was carried out. The results showed that the ACTH values were abnormally high, therefore, a diagnosis of ECS/PPID was made. Therapy was started with Prascend® (½ tablet, 0.5mg per day) at a low introductory dose. The feeding program was altered to decrease carbohydrates. After 6 weeks of therapy the ACTH values were back in normal reference range. After a further 6 weeks, a marked continuous loss of body muscle was occurring. Another blood test showed significantly increased ACTH values again. The dose was increased to 1 Prascend® tablet, however, the ACTH level continued to rise in the following months. During spring of the following year as the ACTH values continued to rise, the Prascend® dose was further increased up to 2mg per day, again without any clinical response. The health of the mare continued to degenerate with weight loss and increasing lethargy.

At this stage, the horse was presented for laser acupuncture therapy. All medication was discontinued at the start of laser acupuncture therapy in order to prevent interference with acupuncture treatment. The same laser acupuncture protocol used for Case 1 was repeated in this mare (Table 2). An obvious change was noted in the

mare 3 hours after the first treatment when she was brought out to pasture. The mare's energy level had improved dramatically and instead of the profound lethargy, she was again showing a keen interest in her environment. It was noted by the owner that this energy level had not been seen in at least 4 years. The therapy was carried out 8 times in the same way over 14 days.

After the initial 2 weeks of treatment, the mare was released home and treatment was continued 7 times a week by a Danish colleague with the same laser equipment and at the same local areas and acupuncture points. The first check-up a week after she was released home showed that the ACTH levels were back to normal, without Prascend® medication. There was steady improvement in muscle mass, with her energy continuing to return to previous normal levels exhibited years before.

The haircoat had a marked change characterized by spontaneous shedding on the day following the sixth treatment. The hair could be wiped off the body in large tufts with the palm of a hand. This spontaneous haircoat change is typical and has been observed before by the author when treating ECS/PPID with laser acupuncture. The horses are then completely devoid of the old haircoat and quickly push a new, healthy coat.

The overall treatment time was approximately 6 weeks. The owner continued monthly treatment of the horse with her own laser (same device) at the same points. Due to the safety profile of the laser used by the author, there have been no adverse events related to owners performing follow-up laser therapy at home, although for maximum eye safety, protective eyeglasses that are sold with the laser can be worn. The at-home treatment by the owner has continued to successfully prevent disease relapse. The mare is now 19 years old and returns to the author's clinic once a year for diagnostics and laser acupuncture therapy. She has completely returned to former activities and remained healthy for 3 years with normal ACTH values in all follow-up bloodwork.

### **Clinical Case Example 3**

A 17-year-old paint horse mare had previously been treated for several months in an equine clinic for ECS/PPID and laminitis. With Prascend therapy (3mg per day), the ACTH values could be kept within an acceptable range but treatment was unable to resolve the chronic laminitis which affected quality of life. The mare was reluctant to move and typically would take about 10 minutes to walk the 10 meters from stable to treatment room. At the end of April, the horse still had a curly winter hair coat. In addition, extremely long chestnuts (approx. 8 cm long) had formed on all 4 legs. In addition to difficulty walking and an abnormal seasonal haircoat, the horse demonstrated severe apathy and depression.

With the start of laser acupuncture, both Prascend® and pain medications for laminitis were discontinued. In addition to the laser therapy protocol used in cases 1 and 2, the treatment protocol was supplemented by intensive daily local therapy for laminitis with the 5x60W laser cluster probe<sup>a</sup>. The laser probe was applied to the cranial aspect of the dorsal hoof horn (Nfr- A'') for 5 minutes per hoof. An alternate treatment used when a cluster probe is not available, is to treat 3 points in the same area of the hoof with the single probe/ Laserpen<sup>a</sup> 90w 904nm for 3 minutes (Nfr- A'') at each point (Figure 5). In addition, the points LU-9 (Rfr- Lung for 30 sec) to promote blood circulation and LI-4 (Rfr- Large Intestine for 30 sec) master point for pain were added to reduce pain.

The day following the first laser therapy treatment, the horse moved substantially better. The horse demonstrated less hoof pain at that point than at the start of treatment while on pain medication. After a week, the walk from stable to treatment room was reduced to 1 minute and the mare was able to move short distances (100 m) comfortably. The depressed mood had improved significantly with the mare neighing at the veterinary staff in greeting when her barn was approached. After another week she could travel 200 m to the paddock, where she now spent 4-5 hours each day. During this time, a more normal appearing haircoat was noticed and the formation of curls had decreased. Simultaneously with the start of the coat change, the extremely long chestnuts were completely sloughed within 2 days on all 4 legs (Figure 6). The ACTH values remained within normal reference range without medication. After 3 weeks of therapy, the mare was able to walk quickly without obvious lameness and was released back to her owner. At home she was treated by the owner for another 14 days. She returned to the clinic where she was treated for the last time with an overall total treatment time of approximately 7 weeks.

### **Discussion**

Laser acupuncture therapy is an effective useful treatment method which is relatively easy to learn and apply. In daily practice, it is an extremely effective therapy for numerous, chronic, degenerative diseases such as ECS/PPID. The cases presented in this report are a small sample of well over 30 ECS/PPID patients, which have been successfully treated with laser acupuncture. They clearly demonstrate that laser acupuncture extends the therapeutic possibilities in the management of this syndrome.

It has been the author's experience over approximately 15 years, that the removal of drugs during laser therapy improves and quickens the clinical outcome of therapy.<sup>8</sup> The waiver of medication, however, is only

advisable to experienced therapists who know exactly what therapy has to done. Until a clinician is completely comfortable with clinical outcomes of this therapy, medications can be continued although it is the author's experience that it generally will slow clinical progress.

In summary, laser acupuncture combined with local laser therapy should be considered for horses with ECS/PPID. Treatment usually takes approximately 6 weeks up to 3 months for recovery and it appears that even horses that have had chronic disease for years can still have positive clinical outcomes. A caveat for healthy maintenance of these horses is to recheck them once or twice a year with a diagnostic and therapeutic laser treatment.

## FOOTNOTES

a Physiolaser Olympic, 90W Impulse Laser, Reimers & Janssen, Berlin, Germany

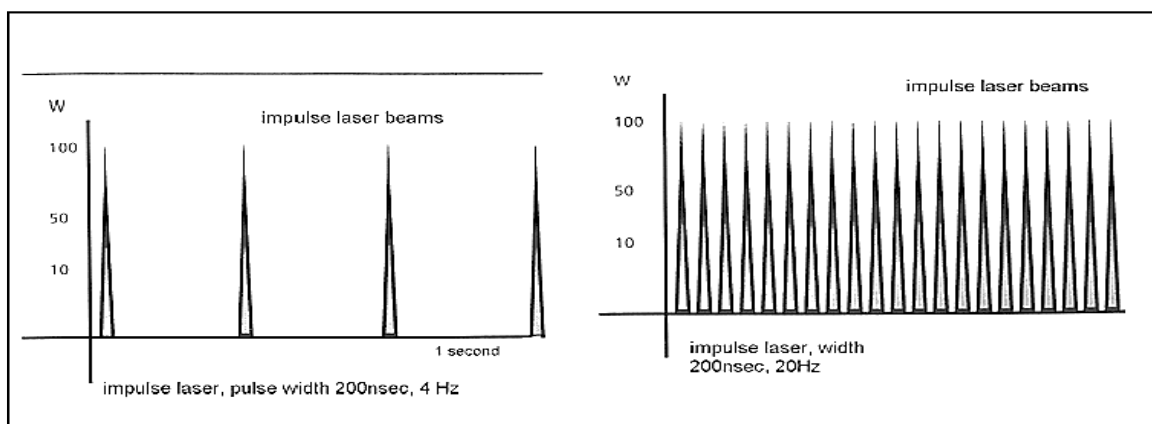
b Prascend®, Pergolide 1 mg tablets; Boehringer Ingelheim Vetmedica Inc, St Joseph, MO, USA

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### Tables and Figures



**Figure 1:** The strength, duration and frequency of light impulses emitted during low level impulse laser therapy with 90 Watts (W) energy output, duration 200 nanoseconds and frequency of 4Hz (left) and 20Hz (right)



**Figure 2:** Picture on left is an example of a Laser Pen (90 watt, 904 nm, pulse laser) and on right is the Physiolaser Olympic (2x 90 Watt, 904nm, impulse lasers); Reimers & Janssen, Berlin, Germany.





**Figure 3:** Case 1 horse at the time of presentation for acupuncture. Note the poor body condition, loss of muscle particularly along the topline and multifocal hyperkeratotic plaques with areas of marked alopecia.



**Figure 4:** Case 1 after 6 weeks of laser acupuncture sessions. Notice the improved haircoat, muscle mass and body condition.



**Figure 5:** Treatment of the hoof with two 90W/904nm impulse laser single probes attached to a Physiolaser Olympic<sup>a</sup> (background) in a horse with laminitis. Areas of cast bandage have been opened in order to apply laser therapy to the hoof wall.



**Figure 6:** Picture of an enlarged (8 cm) sloughing chestnut from a leg in Case 3. After 2 weeks of laser therapy, the horse developed a more normal appearing haircoat and simultaneously the extremely long chestnuts were sloughed on all 4 legs within 2 days.

**Table 1:** Comparison of Nogier, Bahr and Reininger resonance 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				
<b>Indications</b>	Wounds, inflammation, irritable foci in body and teeth		Tendonitis, arthritis, fractures, organ acupoints	Tendonitis, arthritis, fractures, all body acupoints 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				
<b>Indications and Attributes</b>	Deep tissue layer “deep” acupoints (source of illness, related to the sympathetic system)		Central tissue “subsequent” acupoints (related to parasympathetic system)	Surface tissue Omega <i>Ren</i> Channel	Omega <i>Du</i> Channel	Opening acupoints of the 8 Extraordinary Channels	Governing Vessel	Conception Vessel And “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

**Table 2:** Acupoints and their indications, strength, wavelength and frequencies for low level impulse laser treatment of horses with Cushing's syndrome

Acupoints	TCVM Indication	Other	Laser Energy Output (W)	Laser Wavelength (nm)	Pulsing Frequency (Hz) Resonance	Treatment Time (seconds)
TH-6	Triple Heater Fire point	Thyroid gland Acupoint	90	904	TH Meridian frequency 732 Hz	30
LIV-8	Liver Tonifying point	Liver Acupoint	90	904	LIV Meridian frequency 442 Hz	30
LIV-3	Liver <i>Yuan</i> -source Point	Autonomous Liver point Reactive Acupoint LIV <i>Qi</i> Stag	90	904	Bahr Special frequency Master Qi 7659 Hz	30
KID-7	Kidney Tonifying point	Kidney Acupoint	90	904	KID Meridian frequency 611 Hz	30
KID-3	Kidney <i>Yuan</i> -source point	Master point Oscillation	90	904	Bahr 5 9592 Hz	30
KID-2	Kidney Fire point	Reactive Acupoint KID <i>Yin</i> Def	90	904	Bahr Special Frequency Selfheal 4625 Hz	30
GB-41	Opening point <i>Dai-mai</i>	Prostaglandin E1 Acupoint	90	904	Bahr 5 9592 Hz	30
TH-5	Opening point <i>Yang-wei-mai</i>	Thymus Acupoint	90	904	Bahr 5 9592 Hz	30
LIV-13	Spleen Front <i>Mu</i> Alarm Acupoint	ACTH/Pituitary Acupoint	90	904	LIV Meridian frequency 442 Hz	30
SP-2	Spleen Tonifying Acupoint	Pancreas/Spleen Acupoint	90	904	SP Meridian frequency 702 Hz	30

W=watts, nm=nanometers, Hz=hertz or cycles per second