Comparison of High Intensity Laser Stimulation of Acupuncture Points and Therapeutic Ultrasound for Relief of Chronic Lower Back Pain in Horses

Nicha Mongkolrat DVM, Nutthapong Arsakit DVM, Angkana Kidtiwong DVM, Pemika Issariyodom DVM, Ubon Pirunsan BS, MS, PhD, Kannika Na Lampang DVM, PhD, Porrakote Rungsri DVM, MS, Dr Med Vet, DTBVS*

ABSTRACT

Chronic lower back pain is an important cause of decreased performance in sport horses. It can be a complicated diagnosis to make and once identified difficult to treat. The objective of this study was to compare the efficacy of treatment between high intensity laser stimulation of acupuncture points and therapeutic ultrasound in 28 sport horses with chronic low back pain. Horses diagnosed with chronic lower back pain were randomized into 2 treatment groups: high intensity laser stimulation of acupuncture points (HILSA) or therapeutic ultrasound (TU) applied to the lower back (T-18 to sacroiliac joint). The horses received a total of 8 treatments administered every other day during the study period (16 days). The reduction of pain between baseline (Day 0) and after treatment (Day 16) was evaluated both by TCVM acupoint sensitivity scan and pressure algometer. The acupoint sensitivity scan demonstrated statistically significant improvement for both treatment modalities. The HILSA Group change (8.13 ± 8.476) was very significant (p=0.0028) with a 66% change from baseline while the TU Group change (3.77 ± 4.38) was also significant (p=0.0223) with a 34% change from baseline. Comparison of the magnitude of improvement between groups was not statistically significant (p=0.0659). Algometer measurements experienced some limitations with inconsistent results. It can be concluded from study findings that both treatment modalities are associated with a statistically significant reduction of lower back pain in sport horses and selection of treatment can be based on the advantages and disadvantages of each modality dependent on the patient and situation.

Keywords: back pain, therapeutic ultrasound, sport horse, laser acupuncture, high intensity laser

*Address correspondence to Dr. Porrakote (Porrakote.rungsri@cmu.ac.th).

ABBREVIATIONS

HILSA	High intensity laser stimulation acupoints
LAP	Laser acupuncture
NSAIDs	Non-steroidal anti-inflammatory drugs
TCVM	Traditional Chinese veterinary medicine
TU	Therapeutic ultrasound

From: Faculty of Veterinary Medicine, Chiang Mai University, Chiang Mai, Thailand (Arsakit, Mongkolrat, Kidtiwong, Issariyodom), Department of Physical Therapy, Faculty of Associated Medical Sciences, Chiang Mai University, Chiang Mai, Thailand (Pirunsan), Department of Veterinary Biosciences and Veterinary Public Health, Chiang Mai University, Chiang Mai, Thailand (Na Lampang) and Department of Companion Animal and Wildlife Clinic, Chiang Mai University, Chiang Mai, Thailand (Rungsri)

Author Professional Certifications: CVA (Rungsri)

Lower back pain is a common health problem in the horse.[1] It can result in chronic pain with gait altering consequences that limit performance and impair ability to work which constitutes a common concern for equine veterinarians working on performance horses.[1,2] There is increasing interest both in diagnostic methods to enable the recognition of back pain in a horse as the source of poor performance as well as developing therapeutic modalities to manage this clinical disease.[2]

The horse is designed to move in a forward direction at speed, therefore, when asked to perform movements other than this (e.g. jumping, lateral movements), the muscles of the back are prone to injury.[2] Assessment of low back pain in the horse centers on the area from T-18 to the sacroiliac joint.[2] Surveys of equine veterinarians have demonstrated that there is a lack of a tailored diagnostic workflow and consolidated therapeutic approach to pain in this anatomic region of the horse.[1] The types of treatment modalities are many and varied

with a sampling including: non-steroidal anti-inflammatory drugs (NSAIDs), vertebral articular facet injection, acupuncture, laser therapy and therapeutic ultrasound.[1,3-10]

Acupuncture, laser therapy and therapeutic ultrasound have been receiving increased interest from equine veterinarians.[1,2] Acupuncture, in particular, has received publicity and notoriety over the past 20 years in both human and veterinary medicine. The insertion of needles into specific parts of the body has been shown to provide analgesic and therapeutic effects.[11] It has become a popular alternative therapy for the alleviation of chronic lower back pain particularly when drugs are not desired or ineffective and its use in horses continues to increase.[9,12] There are some limited challenges in its use in horses with back pain. Some individuals have a strong dislike for needles placed anywhere on their bodies and can particularly overreact to needles placed in painful anatomic sites. This can lead to a dangerous situation for the veterinarian and limit optimal treatment. A variation of this therapy is to use laser stimulation of acupuncture points. This acupuncture technique to treat chronic low back pain in horses has advantages over other forms of acupuncture in that it is easy to perform, lacks pain during treatment which simplifies restraint and avoids complications from needle puncture (e.g. infection, broken needles).[13] In addition, laser stimulation of acupuncture points is proving to be an efficacious treatment for chronic back pain in horses.[9]

Table 1: Definition of each back pain grade assigned to study horses used to equally distribute the horses according to back pain level between the 2 study groups.

Grade	Definition
Mild	Mean pressure tolerance at trigger point higher than 6.5 lbs/cm^2 with mild muscle spasms when TCVM acupoint sensitivity palpation performed
Moderate	Mean pressure tolerance at trigger point higher than 6.5 lbs/cm^2 with obvious muscle spasms when TCVM acupoint sensitivity palpation performed
Severe	Mean pressure tolerance at trigger point below 6.5 lbs/cm^2 and obvious muscle spasms with trying to avoid the needle cap, grind teeth, bite or kick when TCVM acupoint sensitivity palpation performed
Profound	Mean pressure tolerance at trigger point below 6.5 lbs/cm^2 and severe long lasting muscle spasms with avoidance of the needle cap, grind teeth, bite or kick when TCVM acupoint sensitivity palpation performed

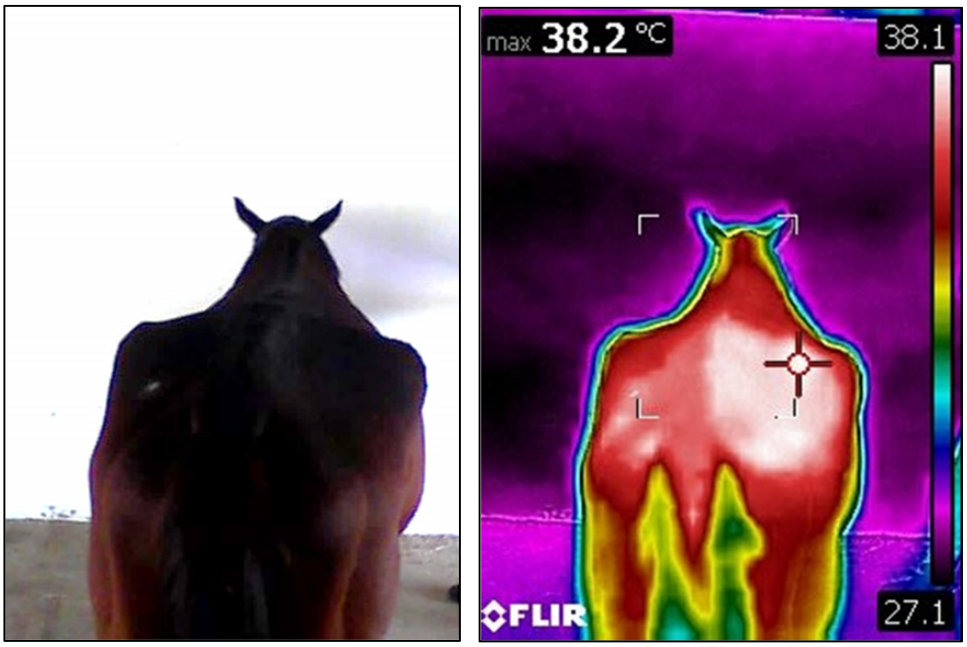

Figure 1: Caudal view of a horse's back before thermography evaluation (left) and the infrared image view (right). The infrared view shows higher temperature on the right side of the back.

Therapeutic ultrasound (TU) is a widely used treatment for musculoskeletal pain in many species. It is a comforting, mildly heating, noninvasive modality used for promotion of tissue repair or prior to stretching of tight or adhered structures.[10] It is regularly used in human physical therapy. Sound waves are absorbed preferentially by collagen rich connective tissues such as ligaments, tendons, fascia and scar tissue. It has proved beneficial for treating tendon/ligament injuries, muscle spasms, joint swelling and mild arthritis.[10] Therapeutic ultrasound (1-3 MHz) is not to be confused with diagnostic ultrasound which operates at higher frequencies (3-7 MHz). Therapeutic ultrasound is the deepest source of heat available, penetrating 5-6 cm deep into tissues. This therapy can be very useful for back pain, especially for large muscle spasms and deeper scar tissue causing pain in the horse.[14] Although ultrasound is considered relatively safe, contraindications include unacceptable temperature increases in the target area with damage to tissue. Unlike ultrasound use on humans where pain from the therapy can be expressed, veterinary practitioners must be attuned to pain behavior exhibited by the horse to avoid tissue injury.

The objective of the present study was to investigate the efficacy of laser acupuncture and therapeutic ultrasound treatment for equine lower back pain relief by measuring pressure algometer change at trigger points and traditional Chinese veterinary medicine (TCVM) acupoint sensitivity scans. The research question around which the design of this study was focused asked which treatment modality is more effective in providing pain relief for sport horses with chronic lower back pain. The study was approved by the Animal Welfare Committee of the Veterinary Medicine Faculty, Chiang Mai University and owners supplied informed consent for horses to participate in the study.

MATERIALS AND METHODS

The population of sport horses considered for enrollment in this study were housed at the Polo Park, Pattaya, Thailand (Barn A) and the Riding Club, Chiang Mai, Thailand (Barn B). Horses from these 2 stables were evaluated for chronic back pain. The criteria for inclusion of a horse in the study was a history of poor performance for at least 3 months, no analgesic/anti-inflammatory medications for 2 weeks prior to evaluation for study enrollment (e.g. glucocorticoids, NSAIDs) and positive for low back pain. A veterinary lameness examination to identify horses with back pain included a computerized lameness analysis[a] program; back palpation using a pressure algometer[b] at trigger points (5-11 lbs/cm^2); positive traditional Chinese veterinary medicine (TCVM) acupoint scan and reduced thoracolumbar flexibility. Exclusion criteria included any of the following: non-weight bearing lameness, hoof abscess (identified by hoof percussion test), medical treatment within 2 weeks before or during the study, poor behavior (refusal to stand in a stall/stock for treatment), an accident occurring during the study or thermographic camera[c] screening identifying acute inflammation on the body or limbs (Figure 1). After diagnosis of chronic low back pain, horses were divided into 4 back pain severity levels: mild, moderate, severe and profound (Table 1). The lameness examination was recorded by video camera[d].

Figure 2: An experienced physiotherapist evaluating pain threshold levels at trigger points using a pressure algometer.

Once a horse met inclusion criteria, the animal was enrolled in the study in a randomized order with equal distribution of horses within a back-pain level between the 2 treatment groups: high intensity laser stimulation of acupuncture points (HILSA) or therapeutic ultrasound (TU). In addition, horses in Barn A were randomly assigned to either the HILSA or TU groups, as were horses located in Barn B. All study horses underwent a standardized battery of exams to collect outcome data at baseline (Day 0) and one more time after 8 treatments spaced every other day (Day 16).

On Day 0 and Day 16, a clinical exam was performed which included an acupoint scan of the Bladder Meridian by applying even pressure with a blunt object (hypodermic needle cap) along the meridian and scoring from 0-3. The "0" score was no response to pressure, "1" a mild muscle spasm, "2" a strong muscle spasm and "3" a very severe spasm with marked avoidance behavior by the horse. The most painful point (trigger point) during the clinical exam (Day 0) was identified and marked (clipped hair). An experienced physiotherapist (PR) evaluated the level of pain at the trigger point (both sides) using a pressure algometer[b] (measures 1 to 22 lbs/cm^2) pressed perpendicular to the trigger point (Figure 2). The scale was read at eye level when the horse showed signs of pain or muscle contraction. Measurements were performed four times with 15 seconds of rest between measurements. Data from the first measurement was discarded. The mean measurement of pain pressure from each side of the back was then calculated from the three measurements. A lower algometer score indicated increased pain while the higher score indicated less pain. The trigger point was assessed again on Day 16 by algometer measurement (study termination).

Treatment of the HILSA study group horses consisted of laser stimulation of selected acupuncture points with a Class 4 high intensity laser unit[e,f] (Tables 2 and 3). Preparation of the area consisted of application of ice for 15 seconds to an area which had the hair clipped marking the acupuncture point (Figure 3). Ice was applied to elicit local vasoconstriction (limit photon

Table 2: Acupuncture points used to treat lower back pain in sport horses.[16]

Acupuncture points	Indications and Actions
BL-21	Back-*shu* association point for ST, promote GI motility, relieve colic pain; diarrhea, colic, constipation, vomiting
BL-23	Back-*shu* association point for KID; urinary incontinence, impotence, edema, ear problems, back pain
BL-25	Back-*shu* association point for LI; diarrhea, constipation, back pain, abdominal pain
BL-26	Gates of *Yuan*-source *Qi*; impotence, urinary incontinence, diarrhea, abdominal pain
Bai-hui	Hind quarter pain, hind quarter paralysis, hip arthritis, contusion, colic, gaseous bowel, diarrhea, wind pattern, *Yang* deficiency, overexertion

ST=Stomach, KID=Kidney, LI=Large intestine

Table 3: Laser irradiation parameters of the high intensity lasers used to stimulate acupuncture points in study horses.

High Intensity Laser Parameters	
Medium	Solid-state: diode
Wavelength	980, 810 nm
Frequency	1 MHz (continuous wave)
Energy Output	1W or 2W
Power Density	1 - 2 W/cm2
Energy Density	12 J/cm2
Time/acupuncture point	12 seconds at 1W or 6 seconds at 2W
Total Joules/acupuncture point	12 J
Spot Size	10 mm (Diameter)
Total Number of Acupuncture Points Used	4 bilateral acupuncture points and *Bai-hui*

absorption by melanin, hemoglobin, oxyhemoglobin chromophores) to allow maximum tissue penetration of laser photonic energy.[15] Acupuncture point stimulation protocol (laser company[e,f] recommended) consisted of applying the laser probe at 1watt (W) energy output with a duration of 12 seconds per acupuncture point or 2W (duration 6 sec per acupoint). Both protocols, which were identical for both lasers, gave the same total dose of laser energy (12 Joules per acupoint) and energy density of 12 J/cm^2, however, the 1W (12 second) duration was recommended by the company representatives to avoid thermal injury (Table 3). During the study, one laser[e] was used in Barn A and the other laser[f] was used in Barn B, with both laser companies supplying the same laser protocols. The acupuncture points treated were BL-21, BL-23, BL-25, BL-26 bilaterally and *Bai-hui* (Figure 3, Table 2).[16] These acupoints were stimulated in all study horses in this group and were chosen because their locations would be proximal, distal and at the site of any painful lumbar area in a horse.[9] In TCVM, acupoints distal to *Qi*-Blood Stagnation (pain) should be included to increase *Qi* flow.[5] Each horse received treatment every other day for 16 days (8 treatments). Between treatment sessions, exercise programs were not controlled.

Figure 3: A study horse's lower back prepared for a laser acupuncture treatment (left). Note shaved areas starting at the most proximal aspect: BL-21, BL-23, BL-25, BL-26 and *Bai-hui.* Laser stimulation of an acupuncture point with the high intensity laser is demonstrated in the right picture.

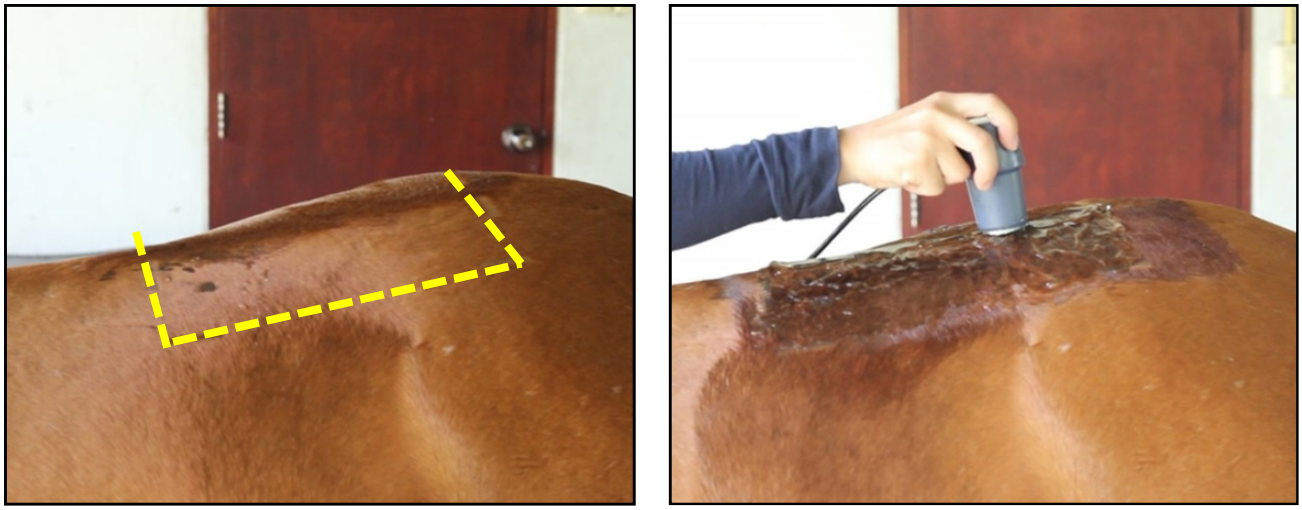

Figure 4: Study horses were prepared for ultrasound treatment by clipping the hair along both sides of the spine (10 cm width) beginning at the last rib extending to the sacroiliac joint (left picture). Before each treatment this area was brushed off, scrubbed with soap, rinsed and then alcohol sprayed over the area before starting treatment with the probe (right picture).

The treatment protocol for the TU group was calculated following the guideline for therapeutic ultrasound.[17] The ultrasound unit[g] power output was set at 2W/cm^2, 1 MHz frequency (continuous pulse), 25 minutes per side duration, probe size of 12.56 cm^2 or power output 2 W/cm^2, 1 MHz frequency (continuous pulse), 20 minutes per side duration and probe size of 19.63 cm^2. The treatment area was prepared before therapy by clipping the hair along both sides of the spine (10 cm width) beginning at the last rib extending to the sacroiliac joint (Figure 4). Each horse received treatment every other day for 16 days (8 treatments). Before each treatment the area was brushed off, scrubbed with soap, rinsed and then alcohol sprayed over the area before starting treatment with the probe. Similar to the laser acupuncture group, the ultrasound group did not have a controlled exercise program between treatments.

Outcome data was determined by 2 measurements: algometer readings at trigger points and TCVM acupoint sensitivity scans. The algometer measurement of trigger point sensitivity was collected pre-treatment (Day 0) and compared to post-treatment (Day 16) for improvement. Data from the 2 groups were compared both for difference before and after treatment within group and back pain improvement after treatment between the 2 study groups (HILSA vs TU). A clinical assessment measurement (acupoint sensitivity scan) was included. Similar to the algometer measurements, acupoint sensitivity change was compared between pre- and post-treatment within a group and then between study groups (HILSA vs TU) for back pain improvement. Paired t-test was used on all parametric data statistical evaluation and the Mann-Whitney U test for non-parametric data[h]. In both analyses, $p<0.05$ was considered significant. Sample size was calculated by a commercial statistical software[h] which generated a population requirement of 20 horses divided into 2 groups.

RESULTS

A total of 50 sport horses from 2 stables were screened for participation in this study. After being evaluated for study inclusion criteria, a final 31 sport horses diagnosed with chronic lower back pain were enrolled. During the study, 3 sport horses were excluded due to medical incidents which caused them to be unable to continue participation in the study. A final 28 horses completed the study. Signalment for study horses included 10 Argentine polo ponies, 2 Thoroughbreds, 10 mixed breeds and 6 ponies with a mean ± SD age of 9.33 ± 3.9 (range 5-16) years. Sex and riding discipline for the study animals included 20 geldings, 1 stallion and 7 mares used as polo sport horses (10/28), jumpers (9/28) and riding horses (9/28). Back pain levels of these horses when they qualified for the study included 6 horses with mild pain, 8 horses as moderate, 11 severe and 3 with profound pain. The horses were randomized into 2 treatment groups with equal distribution of pain levels through the 2 groups and equal distribution between the 2 participating barns (Barn A, Barn B). The HILSA Group (n=15) was treated with high intensity laser at 9 acupuncture points and the TU Group (n=13) received therapeutic ultrasound treatment along the lower back area (T-18 to sacroiliac joints).

The clinical outcome measurement (acupoint sensitivity scan) in the HILSA Group was very statistically significant (p=0.0028) with a mean ±SD difference between pre- and post-treatment of 8.13 ± 8.476 (66% change from baseline) while the TU Group had a statistically significant (p=0.0223) mean difference of 3.77 ± 4.38 (34% change from baseline) (Table 4). The findings for outcome data of pain assessment (pressure algometer measurement) in the HILSA Group when comparing pre- and post-treatment findings demonstrated a mean ± SD difference of 0.657 ± 1.848 (Table 5). The TU Group demonstrated a mean difference of -0.096 ± 1.87.

Table 4: Pre-test versus post-test comparison within a study group for acupuncture point sensitivity scan measured at Day 0 and Day 16 (study completion). Decreased sensitivity scores indicate less pain. Statistical evaluation Wilcoxon (pre-treatment and post-treatment)

Acupuncture Point Sensitivity Scan	High Intensity Laser Acupuncture (rounded value)	Therapeutic Ultrasound (rounded value)
Pre-Treatment	12.3±8.08	11.00±9.005
Post-Treatment	4.17±4.704	7.23±7.18
Difference Pre- versus Post-Treatment	8.13±8.476	3.77±4.38
Percent Change	66.09% (66%) Improved (less pain)	34.27% (34%) Improved (less pain)
p-value	0.0028**	0.0223*

*statistical significance $p<0.05$; **statistical significance $p<0.01$

Table 5: Pre-test versus post-test comparison within a study group for trigger point sensitivity measured by a pressure algometer at Day 0 and Day 16 (study completion). Increased algometer measurement reading indicates less pain at the trigger point. Statistical evaluation paired t-test (pre-treatment and post-treatment).

Algometer Measurement	High Intensity Laser Acupuncture (rounded value)	Therapeutic Ultrasound (rounded value)
Pre-Treatment	8.258±3.172	6.779±2.102
Post-Treatment	8.915±3.214	6.683±1.802
Difference Pre- versus Post-Treatment	0.657±1.848 (0.66±1.85)	-0.096±1.87 (-0.1±1.87)
Percent Change	7.95% (8%) Improved	-1.4% (-1%) No improvement
p-value	0.1651	0.8135

*statistical significance $p<0.05$; **statistical significance $p<0.01$

Table 6: Comparison between groups (HILSA vs TU) for algometer measurement and acupoint sensitivity change for pre-treatment versus post-treatment.

	High Intensity Laser (HILSA)	Therapeutic Ultrasound (TU)	Comparison of change between groups *p*-value
Change between pre-study and post-study acupoint sensitivity scan	8.13±8.476	3.77±4.38	0.0659 (Mann-Whitney U test)
Change between pre-study and post-study algometer measure	0.657±1.848	-0.096±1.87	0.2244 (t-test method)

*statistical significance $p<0.05$; **statistical significance $p<0.01$

Comparison of the magnitude of change from baseline to study termination (Day 16) was compared between the two study groups (HILSA versus TU). Using TCVM acupoint sensitivity scan the change for HILSA was 8.13±8.476 which when compared to the change for TU treatment (3.77±4.38) was not statistically significant (p=0.0659). Comparison of the change in algometer measurement between the two groups (0.657±1.848 HILSA versus -0.096±1.87 TU) was not statistically significant (p=0.2244) (Table 6).

The data was calculated as mean score of pain on each side from TCVM acupoint sensitivity scan (TCVM) and pressure algometer tolerance. All data were expressed as mean ± SD. The designation "N" was equal to number of sides that showed pain. Paired t-test was used to determine the difference between before and after treatment within the same group and to determine mean difference before and after treatment between the HILSA Group and TU Group for pressure algometer tolerance as they exhibited normal distribution. The Wilcoxon test was used for acupoint sensitivity scan (TCVM) on each side as it didn't exhibit normal distribution.

The only adverse event associated with experimental treatments during the study was mild thermal injury (transient swelling, skin scurf/flaking at site) from the first high intensity laser setting (2W for 6 seconds) at the first acupuncture session. Consultation with the laser company recommended an adjusted setting (1W for 12 seconds) which was adopted with no further incidents for the rest of the study.

DISCUSSION

Conventional treatment for chronic low back pain in horses commonly uses a combination of anti-inflammatory drugs and rest, however, alternative treatments such as laser acupuncture and therapeutic ultrasound are garnering increased interest as treatment modalities. In this study, a research question was posed as to whether one alternative treatment modality is better than the other when treating sport horses with chronic lower back pain. Twenty-eight horses with chronic low back pain completed the study receiving either high intensity laser

acupuncture treatment or therapeutic ultrasound. Pain relief was measured by both TCVM acupoint sensitivity scan and pressure algometer at trigger points. Both groups demonstrated statistically significant pre- versus post-treatment back pain improvement as measured by acupoint sensitivity scan (HILSA 66% change from baseline, p=0.0028 and TU 34% change from baseline, p=0.0223). The magnitude of change was not large enough to show a statistically significant difference between groups (p=0.0659). The study findings suggest both treatments are effective with laser acupuncture demonstrating a small non-statistical greater effect on back pain relief under the experimental conditions of this study.

Algometer use in this study had unexpected difficulties which were reflected by inconsistent results. There were dual issues with both the examiner having difficulty maintaining the Fischer's recommended rate of pressure increase of 1 kg/cm^2/s (slow examiner reaction time with nonelectrical algometer) and study horses contracting their back during the measurement.[18,19] The slow examiner reaction time most likely created a trend which produced higher rates of pressure increase. This is reflected in the research findings for this study which noted a range of 5-11 lbs/cm^2 which is higher than the algometer measured 2.67-4.5 lbs/cm^2 for equine back pain reported in a recent study.[2] It is proposed that the higher algometer pain tolerance level in the current study horses was due to the thicker loin muscle bundle (lumbosacral area) used to record algometer measurements versus the thinner withers area which was measured in the former study due to more cranial saddle area pain.[2] It is likely these issues affected the ability of this measurement to accurately and objectively detect back pain changes in the present study horses.

Although no studies were found comparing high intensity laser acupuncture to ultrasound for chronic back pain in horses or humans, there was a study that compared successful treatment using low intensity laser acupoint stimulation for treatment of chronic back pain in horses. The low intensity laser (300mW, 904nm wavelength) was applied for 2 minutes (versus 12 seconds in the present study with high intensity laser) to acupuncture points in 14 horses with chronic back pain for 11 treatments. The authors reported clinical signs of back pain were alleviated in 10 of the 14 horses, there was no change in three, and one was lost to follow-up. Of the 10 horses who were training and competing, four won. One year after treatment was discontinued, 9 of these 10 horses continued to perform at a standard acceptable to the owner.[9]

The use of photonic energy provided by a laser to stimulate acupuncture points in the horse requires high enough energy to penetrate tissue to the average depth of needle acupuncture along with skin safety.[20,21] The development of new technologies in recent years has allowed the invention of therapeutic laser devices with much higher energy output. The Class IV lasers, (>500 mW), ranging to 25W or higher are currently applied not only in surgery but also in laser therapy (i.e. high intensity laser therapy). This technology (Class IV laser) was selected to investigate efficacy in this study as it considerably shortens treatment times, as well as provides adequate photonic energy to stimulate to the tissue depth needed for equine acupuncture points.

The effects of laser therapy at the cellular level have been well described and include stimulation of mitochondrial activity, stimulation of RNA and DNA synthesis, variation of intracellular and extracellular pH, increasing cell metabolism with increased protein production and modulation of enzymatic activity.[22] In contrast to the therapeutic use of lasers where light affects the metabolic processes of target cells (photobiomodulation), laser acupuncture (LAP) is reported to affect neural response in the same way as needle acupuncture.[22] It appears to work by suppressing pain using neurological and humoral mechanisms, similar to needles.[22] In humans, several functional magnetic resonance imaging (MRI)-based analyses have demonstrated comparable cerebral activity patterns when LAP is compared to needle acupuncture.[23-25] Additional comparative studies have noted needle stimulation acts as an exponential peak with quick return to baseline whereas laser stimulation is more plateau-like with a lower peak but longer duration.[26]

Limitations to optimal conduct of this study included the inability to effectively blind investigators because of shaved hair coat patterns (acupuncture sites and bilateral ultrasound sites) which could create bias. Exercise was not controlled for the study horses due to creating economic loss for owners who had horses participating in the study. The lack of similar exercise patterns for all horses could have created additional injury in some horses which might affect study outcome. This problem was addressed by observing study horses closely and any horses with recognizable injury were dropped from the study. This caused a decrease from 31 horses that started the study to 28 horses that completed the study.

An unexpected adverse side effect, thermal injury, occurred during the study when the HILSA Group was treated using a protocol of 2W for 6 seconds per acupuncture point. The lesions were characterized by a 1 cm area of hair loss with surface crusting with return to normal appearance in approximately 2 weeks. The commercial laser company suggestion to use a power of 1W with a duration 12 seconds per acupuncture point (12 J/cm^2) corrected the issue and no further adverse effects occurred.

When comparing the ease of each mode of treatment, the procedure was simpler for the HILSA Group. The only preparation for this group was placing an ice pack on each acupuncture point for 15 seconds prior to laser stimulation of an acupuncture point while in the TU group, preparation of the treatment area was lengthy. The TU application site had to be brushed off, cleaned and then sprayed with alcohol before the treatment could begin. Total treatment time was markedly longer in this group (20-25 minutes per side, total 40-50 minutes) versus HILSA (12 seconds per point, total 1.8 minutes).

Using high intensity laser acupuncture was practical for field use, whereas the therapeutic ultrasound was not. The one negative aspect of HILSA use was the significantly higher equipment acquisition cost when compared to TU.

In summary, high intensity laser acupuncture was compared to therapeutic ultrasound for the treatment of chronic lower back pain in horses over a period of 16 days encompassing 8 treatment sessions. Both treatment modalities were effective with a slight edge to laser acupuncture for ease of use in the field and greater pain relief (non-statistical significance) when compared to therapeutic ultrasound. The choice of treatment, therefore, for chronic lower back pain in horses should consider the advantages and disadvantages of each treatment modality as it applies to the individual patient and situation presented.

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FOOTNOTES

a. EquinosisTM, Equinosis, LLC, Columbia, MO, USA
b. Wagner Pain Test™ Model FPK Algometer, Wagner Instruments, Greenwich CT, USA
c. FLIR C3, FLIR Systemic, Inc., Oregon, USA
d. Panasonic HCV-180, Panasonic Corporation, Osaka, Japan
e. Companion Animal laser, Companion Animal Health, LiteCure, LLC, New Castle, DE, USA
f. BTL 6000 Laser, BTL Industries Ltd, Stevenage, Hertfordshire, United Kingdom
g. Enraf-Nonius Sonoplus 190, Enraf-Nonius B.V., Rotterdam, Netherlands
h. G*Power. Version 3.1.9.2 statistical software; Franz Faul, Universität. Kiel, Germany

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