

Response to acupuncture treatment in horses with chronic laminitis

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Abstract – There is a need for evidence-based scientific research to address the question of the effectiveness of acupuncture in improving clinical signs of laminitis in horses. The objective of this study was to compare lameness levels before and after 2 acupuncture treatments in horses with chronic laminitis. Twelve adult horses with chronic laminitis received 2 acupuncture treatments 1 week apart. The points were treated using dry needling, hemo-acupuncture, and aqua-acupuncture. Lameness level was objectively evaluated using an inertial sensor-based lameness evaluation system (Lameness Locator), as well as routine examinations following American Association of Equine Practitioners scoring before the first and 1 week after the second acupuncture treatment. Data were analyzed using Wilcoxon signed-rank test and P -values < 0.05 were considered statistically significant. Both the Lameness Locator ($P = 0.0269$) and routine lameness examination ($P = 0.0039$) showed a significant reduction in lameness severity. Our results support using acupuncture, along with other treatment options, in treating chronic equine laminitis.

Résumé – Réponse à un traitement à l'acupuncture chez des chevaux atteints de laminite chronique. Il existe un besoin de recherche scientifique factuelle afin d'aborder la question de l'efficacité de l'acupuncture pour améliorer les signes cliniques de la laminite chez les chevaux. L'objectif de cette étude consistait à comparer les niveaux de boiterie avant et après deux traitements d'acupuncture chez des chevaux atteints de laminite chronique. Douze chevaux adultes souffrant de laminite chronique ont reçu deux traitements d'acupuncture à 1 semaine d'intervalle. Les points ont été traités en utilisant des aiguilles, l'hémo-acupuncture et l'aqua-acupuncture. Le niveau de boiterie a été évalué objectivement en utilisant un système inertiel d'évaluation de la boiterie à base de sonde (repérage de la boiterie) ainsi qu'à l'aide d'examen de routine en se basant sur la notation de l'American Association of Equine Practitioners avant le premier traitement et 1 semaine après le deuxième traitement d'acupuncture. Les données ont été analysées en utilisant les tests de rang signés de Wilcoxon et des valeurs $P < 0,05$ étaient considérées comme étant significatives sur le plan statistique. Le repérage de la boiterie ($P = 0,0269$) et l'examen de routine de la boiterie ($P = 0,0039$) ont montré une réduction significative de la gravité de la boiterie. Nos résultats appuient l'utilisation de l'acupuncture, conjointement à d'autres options de traitement, pour traiter la laminite équine chronique.

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Introduction

Laminitis is a complicated and interrelated sequence of inflammatory and vascular events which affect the lamellar tissues of the hoof. These events result in breakdown of interdigitation between the epidermal and dermal lamellae which

consequently inflicts severe pain and disability in horses (1). Within the horse population, laminitis is a common and severe disease. A previous study reported that 13% of horse operations were affected by laminitis annually (2). Furthermore, 48% of horses with laminitis referred to veterinary teaching hospitals were eventually euthanized (3). Though several theories have been presented, including mechanical, metabolic, and nutritional disorders, the etiology and pathogenesis of laminitis remain inconclusive and largely unknown; the treatment options therefore have only a limited scientific basis (4,5). Generally, multi-modal and symptomatic therapy has been indicated including medication, mechanical support, and dietary restriction (1). However, efficacy is often limited and, at times, euthanasia is inevitable (3,6,7).

While allopathic medicine has not been very successful in treating laminitis, there is circumstantial evidence that acupuncture reduces patient's lameness and suffering; however, evidenced-based scientific research is scarce (8). Acupuncture

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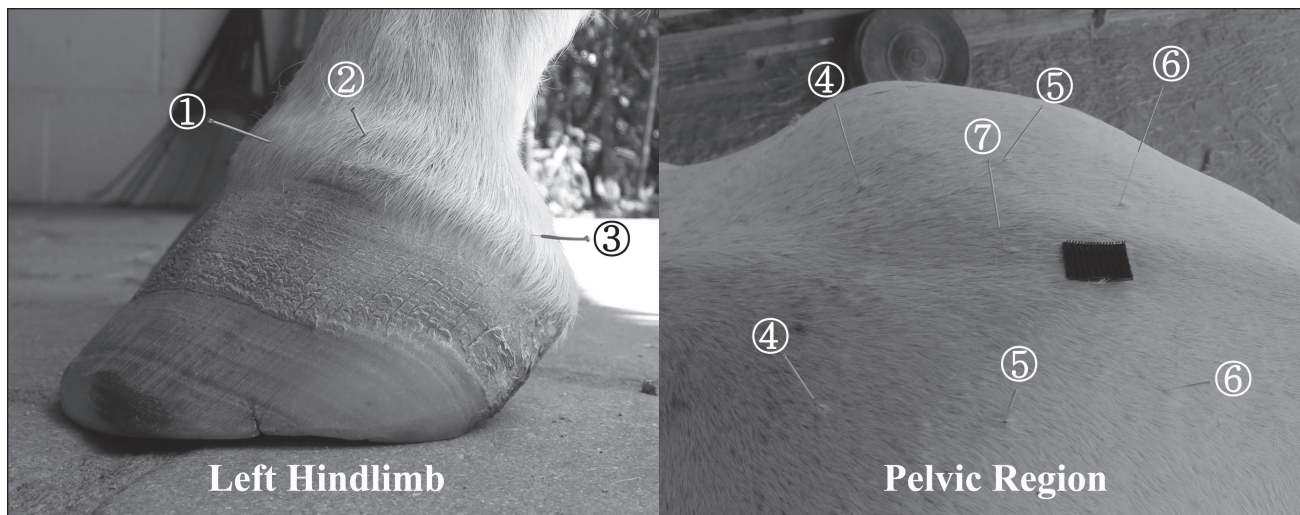


Figure 1. Additional selected acupoints based on the results of diagnostic acupuncture palpation examination: ① Stomach-45, ② Gallbladder-44, ③ Bladder-67, ④ Bladder-25, ⑤ Bladder-26, ⑥ Bladder-27, and ⑦ BAI-HUI point.

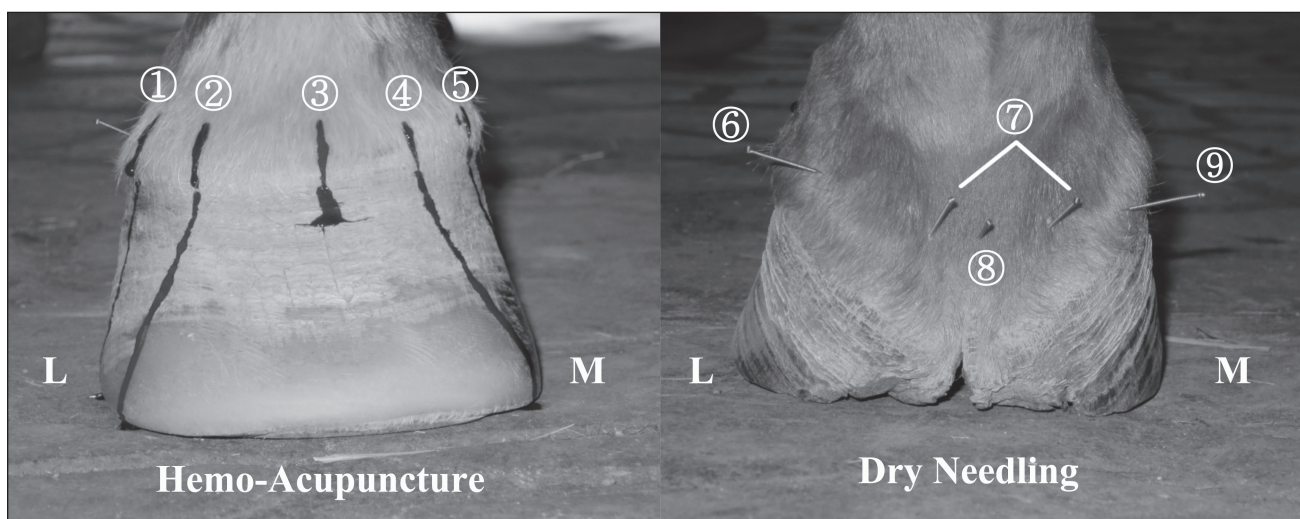


Figure 2. Treatment formula. Hemo-acupuncture in dorsal region (left); from lateral (L) to medial (M): ① Small Intestine-1, ② QIAN-TI-TOU point, ③ Triple Heater-1, ④ QIAN-TI-TOU mirror point, and ⑤ Large Intestine-1. Dry needling in palmar region (right); from lateral (L) to medial (M), ⑥ Heart-9, ⑦ QIAN-TI-MEN point, ⑧ Pericardium-9, and ⑨ Lung-11.

has been widely used as a complementary treatment option in human and veterinary medicine to produce analgesic effects, normalize physiologic functions, and treat clinical disorders (9). Many recent studies have focused on the effect of acupuncture in treating various aspects of equine diseases such as musculoskeletal, gastrointestinal, respiratory, and reproductive disorders; nonetheless, there is a lack of evidence-based research supporting the efficacy of acupuncture in treating laminitis (6,8). The purpose of this study was to objectively evaluate the effect of acupuncture treatment on the lameness level in horses with chronic laminitis. It was hypothesized that acupuncture would reduce lameness severity in horses with chronic laminitis.

Materials and methods

Animals

Twelve adult horses [mean 16.9 y \pm 5.7 y standard deviation (SD) old] with chronic laminitis from one geographical area were selected. Age, breed, gender, initial degree of lameness, and duration of lameness were recorded. All horses in this study had been suffering from chronic laminitis for several months. Referring veterinarians had confirmed a diagnosis *via* clinical examination and radiography more than a month before the study was performed. The etiology of laminitis was beyond the scope of this study but the owners suggested

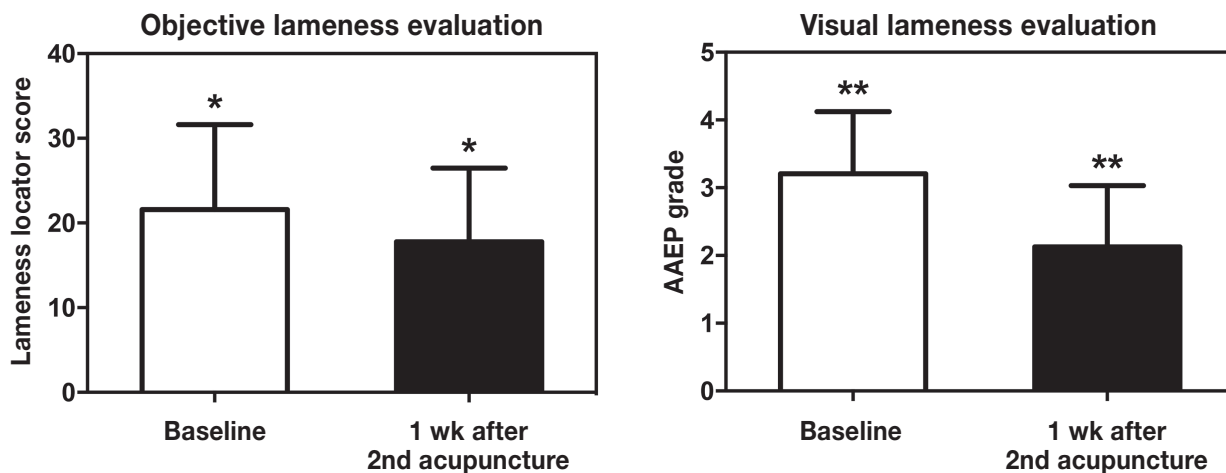


Figure 3. Differences in the lameness level between the baseline (before the first acupuncture) and 1 week after the second acupuncture by objective (Lameness Locator) lameness evaluation (left) and routine (AAEP grading) lameness evaluation (right). There was a significant reduction in lameness severity after acupuncture treatment. * $P < 0.05$; ** $P < 0.01$.

metabolic disorder ($n = 2$), nutrition ($n = 2$), mechanical failure/improper shoeing ($n = 2$), and unidentified reasons ($n = 6$) as likely etiologies. The duration and cause of laminitis were not included in the analysis. A few horses were regularly receiving medications (e.g., Pergolide, Firocoxib) or supplements, and the owners were advised to maintain previous medicinal treatments during the study. Eight horses were using therapeutic shoeing; no further trimming/shoeing was advised during the study. This study was approved by the Institutional Animal Care and Use Committee and owners' consent was obtained.

Lameness evaluation

An objective lameness evaluation was conducted using a wireless, body-mounted inertial gyroscope and accelerometer system called the "Lameness Locator" (Equinosis LLC, St. Louis, Missouri, USA). Three small wireless sensors were mounted on the horse's body. One axial accelerometer was mounted on the head and one on the pelvis, while a single-axial gyroscope was placed on the dorsal aspect of the right front pastern. The wireless data from vertical acceleration of the head and pelvis and angular velocity of the right forelimb were collected using a laptop computer, analyzed, and reported as 'Vector Sum.' The Lameness Locator has been successfully used in previous studies to evaluate lameness in horses (10–12). In addition, lameness severity was evaluated using a routine visual lameness examination based on the American Association of Equine Practitioners (AAEP) recommended 0 to 5 grading system (13). Lameness examination was carried out before the first and 1 wk after the second acupuncture treatment. To ensure consistency and accuracy, the lameness evaluation was replicated 3 times for each horse and the arithmetic mean was calculated and used for statistical analyses.

Acupuncture treatments

A diagnostic acupuncture palpation examination was performed on all horses before each treatment and appropriate acupuncture points were selected and treated (Figure 1). Each

horse received 2 treatments one week apart. The acupuncture treatments included dry needling, hemo-acupuncture, and aqua-acupuncture depending on the nature of the problem and the location of the acupuncture points treated. For consistency, hemo-acupuncture (*Small Intestine-1*, *Triple Heater-1*, *Large Intestine-1*, *QIAN-TI-TOU*, and *QIAN-TI-TOU* mirror points) and dry needling (*Heart-9*, *Pericardium-9*, *Lung-11*, and *QIAN-TI-MEN* points) were used as a basic treatment formula for all the horses in this study (Figure 2).

Statistical analysis

All statistical analyses were conducted using SAS software for Windows version 9.3 (SAS Institute, Cary, North Carolina, USA). Descriptive statistics are presented as means and standard deviations for continuous variables. Data were not normally distributed; therefore, non-parametric analysis was required. Lameness severity from before the first and after the second acupuncture treatment was analyzed via Wilcoxon signed-rank test. All statistical tests were one-sided and P -values < 0.05 were considered statistically significant.

Results

The severity and painfulness of the condition, and resultant lameness severity, varied among horses. Using the AAEP evaluation scale, lameness varied from 1 degree to 4 degrees before the treatment and 1 degree to 3.5 degrees after. The mean lameness severity, following AAEP grading, decreased 1 degree, from 3.27 degrees at baseline to 2.27 degrees after the second acupuncture treatment. Results from the objective lameness evaluation using the Lameness Locator (LL) were consistent with AAEP grading. Results from both visual lameness evaluation ($P = 0.0039$) and LL ($P = 0.0269$) showed a significant reduction in lameness severity between these 2 time periods (Figure 3).

Discussion

Due to limited research studies and a growing interest in holistic medicine from both clinicians and clients, there is a need for advancing evidentiary research in veterinary acupuncture (14).

Our results support the anecdotal evidence that acupuncture can alleviate the level of lameness and pain in horses with chronic laminitis.

The treatment of chronic laminitis varies with the severity of clinical signs and response to treatment. Overall, the goal is to treat the underlying disease, if applicable, decrease the pain and lameness with medications [e.g., non-steroidal anti-inflammatory drugs (NSAIDs)], and reduce stress of the lamellar junction (e.g., modifying hoof biomechanics by therapeutic trimming/shoeing) (1). Nonetheless, the treatment plan may not be successful; it has been reported that 67% of laminitic horses suffering from persistent lameness were eventually euthanized (3). While current treatment options are limited, and at times unsuccessful, acupuncture has been successfully implemented in a gradually increasing number of cases. Acupuncture provides a drug-free and safe alternative treatment with minimum side effects and rare adverse reactions (15,16).

Acupuncture influences multiple organs and tissues which are commonly involved in the development of laminitis, such as the musculoskeletal, gastrointestinal, and immune systems (17). It has been suggested that acupuncture prevents and modifies the perception of pain at many different levels of the nervous system including an increase in opioid peptides secretion, oxytocin concentration, and activation of serotonin receptors (18–21). Acupuncture may also increase nitric oxide (NO) synthase activity around meridians and acupoints (22). It has been reported that NO is a key regulator of local circulation and may improve local circulation of L-arginine and glyceryl trinitrate (23,24). In the present study, we used hemo-acupuncture as part of our treatment formula for all horses. Hemo-acupuncture causes bleeding at acupoints and is associated with the phlebotomy effect, which might relieve extravasated blood stagnation and therefore improve local circulation (25). Laminitis is associated with hypoperfusion, ischemia, and necrosis of lamellae (1). It has been stated that destruction of the lamellar basement membrane is associated with activation and deactivation of metalloproteinases (MMPs), including MMP-2 and MMP-9 as well as a disintegrin and metalloproteinase with thrombospondin motifs-4 (ADAMTS-4); which are significant in the development of laminitis (26–29). Previous studies on human and laboratory animals showed that acupuncture inhibits expression and activation of MMP-2 and MMP-9 (30,31). Hence, it is possible that acupuncture may not only improve the immediate clinical signs, but may also prevent the progression and recurrence (e.g., occurrence of acute episodes) of laminitis; yet, more research is warranted. The complex nature of laminitis and the likelihood of acupuncture influence on several body systems suggest acupuncture as an appropriate ancillary treatment (6,32). Furthermore, acupuncture treatment does not interfere with other treatments such as therapeutic shoeing, medications, dietary restrictions; thus, it can be offered in parallel with other treatments of chronic laminitis. Our data suggest that acupuncture is effective in decreasing lameness in horses with chronic laminitis.

This study applied 2 weekly acupuncture treatments with lameness examinations before the treatment and 1 week after the second treatment. Further research is needed to determine

the optimum number and frequency of acupuncture treatments to achieve the maximum benefit for this condition, as well as how long the therapeutic effects of the acupuncture continue after the last treatment. Future studies should include a focus on treatment effect in relation to causative factors as this study did not differentiate among laminitis etiologies. Due to the limited number of available horses for the study, it was not feasible to include a control group and maintain the required power for statistical analysis. Investigation into acupuncture treatments involving a robust control group will also illuminate important aspects of this procedure.

Pain control in horses with chronic laminitis is critical for prognosis and rehabilitation. The results of this study provide objective evidence that acupuncture treatment reduces the severity of lameness in horses with chronic laminitis; consequently, acupuncture could be considered along with other treatment options in horses suffering from chronic laminitis.

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