Brief Communications

Preliminary Evaluation of the Effect of Acupuncture on Acoustic Myographic Recordings in Five Sport Horses

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ABSTRACT

The objective of this prospective controlled study was to assess the effect of acupuncture (ACU) on acoustic myography (AM) of the middle gluteal muscle at the walk and trot in healthy sport horses (n=5). Acoustic myographic sensors were placed on the surface of the right and left middle gluteal muscles. Recordings were taken while the horses were walked and trotted in hand, in a straight line, before and immediately after ACU treatments, and 48 hours and one week afterwards. Acoustic myographic data was used to calculate an acoustic myographic (EST) score. Due to the small number of horses in this pilot study, data was presented descriptively. Gait abnormalities and sensitivity at routine ACU points were recorded at each session. All horses tolerated the procedure well and did not exhibit any signs of lameness at any time. Sensitivity at ACU points was present initially in 3 horses and was abolished immediately after ACU in all of them. All horses had an increased EST score after 48 hours, of which 3 had a persistent increase for 1 week afterwards, suggesting a greater speed of activation of muscle fibers after ACU. AM is a non-invasive technique, which is well tolerated and easily performed in a routine clinical setting. This small pilot study suggests a change in acoustic myographic data after ACU treatment but this will need to be confirmed in a greater number of horses.

Key words: Acupuncture, acoustic myography, sport horses

ABBREVIATIONS

ACU	Acupuncture
AM	Acoustic myography
DAPE	Diagnostic acupuncture palpation exam
E	Efficiency
S	Spatial amplitude
T	Temporal summation
EST score	Acoustic myographic score

Acupuncture (ACU) is part of Traditional Chinese Medicine and involves stimulating points on the body surface with acupuncture needles. The effects of ACU cannot be explained in terms of a single mechanism, but involve a series of interactions between the nervous, endocrine, and the immune systems. Mechanisms of action are still not fully understood but studies have shown that needle stimulation of acupuncture points causes microtrauma that produces a local inflammatory reaction, which results in an increased local tissue immune response, improved local tissue blood flow, and muscle relaxation.[1-6] Studies in humans, have suggested that ACU might stimulate motor nerve fibers, and as such, increase muscle activity.[7, 8] Other studies suggest that the effect of ACU might be related to the inhibition of excitability of the alpha motor neuron. [9]

In horses, the use of ACU as a therapeutic modality has increased significantly over the last 20 years, however scientific evidence to support this practice is somewhat lacking.[10] Recently, multiple studies have been performed to assess the efficacy of ACU in the treatment of various conditions, such as Equine Herpes Virus type 1, chronic back pain and laryngeal hemiplegia. [5, 11-13] Additionally, sport horses that have sensitivity to palpation of ACU points are more likely to be lame.[14] There continues to be a need for clinical studies proving the efficacy of ACU.

Acoustic myography (AM) is a non-invasive technique that measures muscle activity by capturing the sounds generated by muscle contractions.[15-17] The CURO system®[a] is a commercially available AM system that has

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been validated in horses.[18] The objective of this study was to assess the effect of ACU treatment on AM recordings of the middle gluteal muscle in healthy sport horses. We hypothesized that ACU, would improve the efficiency of muscle contraction during exercise, and this would be reflected on the AM recordings.

MATERIALS AND METHODS

Five client-owned sport horses (Warmblood geldings) were included in the study after approval by the Animal Care and Use Committee of the University of California, Davis. All horses were deemed healthy based on physical and lameness examinations and the absence of recent medical issues. These horses were ridden regularly and competing in showjumping and were free of any forelimb or hindlimb gait abnormality.

Acoustic myographic (AM) data was recorded from each horse at the walk and trot in a straight line. The horses were evaluated at their respective training facility on a consistent surface, either a sand- or gravel-based hard surface. The horses were handled by the same handler throughout the study period. Each horse was instrumented with a commercially available system (CURO system®)[1] consisting of 2 single-use calibrated sensors (dimensions 9.5x14.5x3.5cm; weight 290g) (Figure 1). Each sensor was placed 3 inches abaxially to the pelvic midline over the middle gluteal muscle, after the skin was cleaned with water and prepared with ultrasound gel to increase the contact between the sensor and the skin. The sensors were kept in place with adhesive foam tape included with the CURO system[a] (Figure 2). The CURO system[a] was placed in a pouch and attached to a surcingle, for real time recordings. Data were digitally sampled at 2-250 Hz in real time and analyzed by the CURO software[a]. Horses were evaluated on day 0, day 2, and day 7 during the month of March at the same time and in a consistent order.

The AM measurements and diagnostic acupuncture palpation exam (DAPE) were recorded before and after ACU, on day 0, 2, and 7, at the walk and trot. The DAPE was performed as previously described immediately prior to ACU.[14] ACU was performed by the same certified equine veterinary acupuncturist (S.L.J.) and consisted of placement of sterile, stainless steel, 0.30 mm x 50 mm AP needles[b] at fifteen standard and commonly used acupoints: PC-9 bilaterally, Bai-Hui, GB-21 bilaterally, BL-10 bilaterally, BL-21 bilaterally, BL-23 bilaterally, BL-54 bilaterally, BL-40 bilaterally.[19, 20] The needles were inserted to a depth of 20 mm, no manipulation of the needles was performed after insertion, and they were left in place for ten minutes after the last needle was placed. On each treatment day, sensitivity to the DAPE was evaluated and recorded prior to the AM recording as previously described (Table 1).[14]

AM recordings were transformed into E, S, T values by a commercially available acoustic myographic system[a]. This system measures 3 parameters involving muscular contractions: efficiency (E),which is the way the Central Nervous System (CNS) recruits and uses the active fibers in a muscle, spatial amplitude (S), or the number of active fibers and temporal summation (T), defined as the frequency with which the muscular fibers contract. The acoustic myographic score or EST score was calculated by the following formula: EST average left: (EL+SL+TL)/3 and EST average right: (ER+SR+TR)/3.

Statistical evaluation of data in this pilot study was not performed due to small study animal size which does not allow meaningful statistical interpretation. Study data is therefore presented descriptively.

Figure 1: Image of the CURO system including specifications. Myodynamik Aps (Denmark)

Figure 2: Image of a horse instrumented with the CURO system

RESULTS

The 5 horses included in this study were client-owned Warmblood geldings, ranging in age from 6 to 15 years (mean age 9 years, median 6 years), and were all professionally trained show-jumping horses. The horses were deemed systemically healthy, and no evidence of lameness was observed at any time point during the study period. All horses tolerated the surcingle with the AM system and the ACU treatment well.

Of the 5 horses included in the study, 3 showed sensitivity to DAPE initially. None of the horses showed sensitivity to the DAPE 48 hours after ACU. One week after ACU treatment, 4/5 horses showed no sensitivity to the DAPE scan and 2/5 horses had no sensitivity to DAPE at any time during the study (Table 2). All horses had an increased EST score after 48 hours at the walk and trot, with 3 horses demonstrating a persistent increase for 1 week following ACU treatment (Figure 3 and 4).

Table 1: Criteria for acupoint sensitivity during DAPE. Le Jeune SS et al. Prospective Study on the Correlation of Positive Acupuncture Scans and Lameness in 102 Performance Horses AJTCVM Vol 9, No.2, August 2014

Grade	Criteria
1	An inconsistent localized flinch
2	A mild consistent localized flinch
3	A moderate consistent flinch
4	A severe flinch
5	Severe flinching with evasion and may kick or bite

Table 2: Comparison of the sensitivity to the **DAPE** in each individual horse along the study period time. Horses are listed in the order the procedure was performed. ( ) grade of sensitivity according to 'criteria' previously described: le Jeune SS et al, 2014

Horse	Day 0 Left side	Day 0 Right side	Day 2 Left side	Day 2 Right side	Day 7 Left side	Day 7 Right side
#1	Stomach 10 (2) Bladder 18-19 (3) Bladder 54 (4)	Bladder 18-19 (3) Bladder 54 (4)	Clear	Clear	Bladder 18-21 (2)	Clear
#2	Bladder 54 (2)	Clear	Clear	Clear	Clear	Clear
#3	Bladder 23 (2) Bladder 54 (1)	Clear	Clear	Clear	Clear	Clear
#4	Clear	Clear	Clear	Clear	Clear	Clear
#5	Clear	Clear	Clear	Clear	Clear	Clear

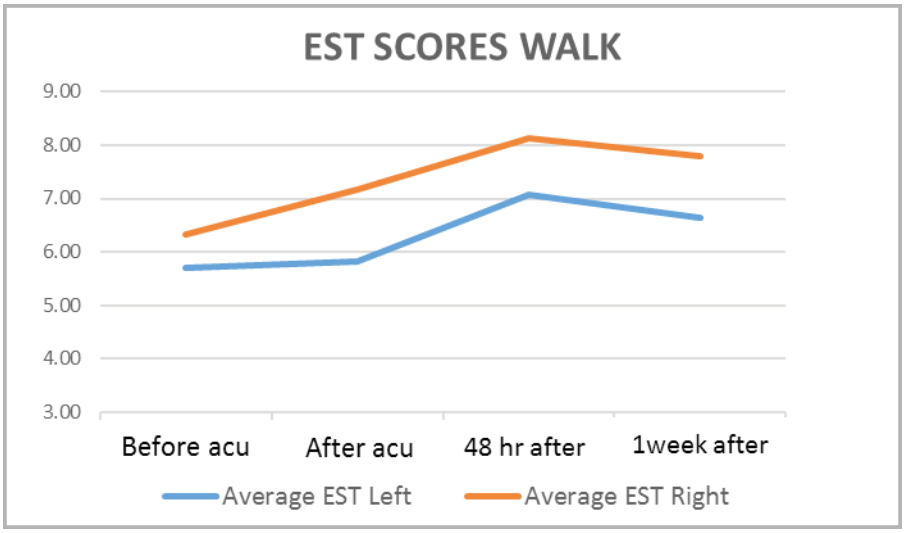

Figure 3: Comparison of the mean **EST scores** of the left and right middle gluteal muscles while horses were walked in a straight line, over the course of the study. This graph represents the beneficial effects observed in 3/5 horses in the present study.

DISCUSSION

There is a need for evidence based clinical studies evaluating the efficacy of acupuncture, particularly for lameness in horses. Sensitivity at certain acupoints has previously been correlated to pain at specific anatomic sites in one study which demonstrated the association of a positive DAPE with lameness in sport horses.[14, 21-23] Results of that study support that positive responses to the DAPE are closely associated with lameness (accuracy, sensitivity and specificity near 80%). Acoustic myography (AM) is a non-invasive technique that measures muscle activity by capturing the sounds generated by muscle contractions. It appears to lend itself to measuring changes in muscle use which can be correlated with pain detection by DAPE and pain relief associated with ACU treatment.[15-17] The use of AM has been validated both in research horses in the gluteus medius muscle and in humans demonstrating its robust potential for assessment of force production and fatigue.[17, 18, 24] This procedure is particularly appealing for use in performance horses as it is non-invasive and could easily be performed in a clinical setting on any superficial muscle.

The objective of this pilot study was to assess whether or not ACU has an appreciable effect on AM recordings, as measured by the effect on muscular activity of the gluteus medius in sport horses. This muscle was selected because of its previous validation for AM use, superficial location and its importance for propulsion as extensor of the hip and abductor of the limb.[25] The position of the AM sensors was selected as to not interfere with the DAPE and ACU. Unlike electromyography, which is very placement sensitive in terms of signal strength, the AM signal remains relatively constant throughout the surface of a contracting muscle.[15-17] The main advantage of AM is therefore that the innervation zone or the tendinous regions can be used for sensor placement. Thus the AM sensors can be placed anywhere on the muscle of interest to receive a reliable signal.

The acupuncture palpation exam (DAPE) was performed by the same certified acupuncturist (SLJ), just prior to AM measurement, reducing variability in this measurement in the study. The AM measurements (EST score) and DAPE measurements were recorded both before and after ACU in sound horses on a straight line at walk and trot. Encouragingly, 5/5 horses had increased EST scores 48 hours after ACU, suggesting an improvement of the muscle efficiency after ACU which supported the study hypothesis. In addition, there was improvement in DAPE scores (5/5) at 48 hours post ACU and persisted in 3 horses at 1 week.

The results of this study suggest that ACU could affect muscle by altering the efficiency of the contractions which is important to equine locomotion. These results are tempered by the limitations of this pilot study which are small sample size, no control group, no lameness in the study group and horses evaluated in a straight line so subtle gait asymmetry might not be detected. Even with these limitations, this study demonstrated that AM is a non-invasive technique which is well tolerated and easily performed in a routine clinical setting. The effect of ACU on AM was easily identified by changes in AM data after ACU treatment in the study horses. The results of this pilot study are encouraging, therefore, further studies need to be performed in a greater number of horses along with inclusion of lame horses to evaluate the effects identified in this study and validate these statistically.

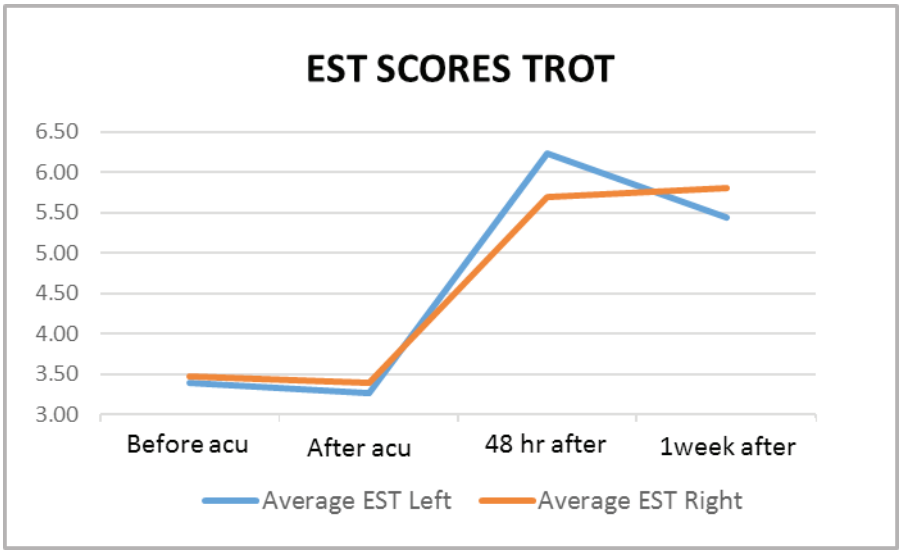

Figure 4: Comparison of the mean EST scores of the left and right middle gluteal muscles while horses were trotted in a straight line, over the course of the study. This graph represents the beneficial effects observed in 3/5 horses in the present study.

FOOTNOTES

a. CURO System, MyoDynamiks Aps, Denmark
b. Vinco, Helio Medical Supplies, Inc, San Jose, CA

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