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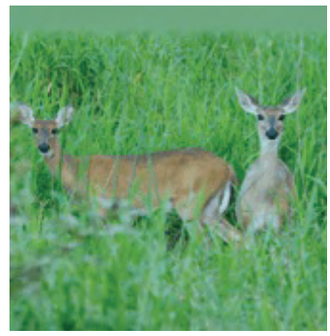

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SCIENTIFIC REPORT

Infrared Thermal Imaging Quantifies the Efficacy of IceWave® Patches in Musculoskeletal Pain Relief in Horses

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Abstract

Veterinarians working with performance and pet horses on a daily basis have tremendous interest in drug-free pain relief and management of the very common musculoskeletal problems that these horses may experience. In an initial study carried out on 142 horses in 2005, it was demonstrated that horses responded dramatically to LifeWave® Energy Patches. In this study, 137 out of 138 horses with mild to severe back pain, responded favorably and showed consistent pain relief manifesting more observed energy and power. Other published double-blind placebo-controlled studies in humans have demonstrated a skin cooling effect or an autonomic nervous system response elicited by these patches. The main objective of the present study was to follow up on the initial study in horses and use infrared thermal imaging to quantify the efficacy of IceWave® patches in pain relief and management. Thermal measurements and imaging were complemented with acupuncture palpation evaluations performed by the veterinarian. It was also of interest to explore the effects of these patches on painful and inflamed areas in horses and demonstrate their physiological cooling impact and further cross-validate with the veterinarian's expert physical assessments. The hypothesis to be tested was that: IceWave® Patches produce a highly significant cooling effect (pain reduction) in the areas affected by pain in horses.

Thirty eight horses: 1 stallion, 25 geldings and 12 mares of varying ages (5 to 30 years old- with 3 horses considered elderly, at 29, 28, 30) and disciplines were included in this study. Informed consents were acquired from the owners of qualified candidates. Study subjects with pain symptoms had their area of pain scanned with an infrared thermal imaging system. Horses were scanned 4 to 10 times providing a total of 165 thermal measurements. They were further evaluated to assess pain severity based on acupuncture palpations (on a scale of 1-10) and physiological symptoms reflected as thermal changes captured by the infrared camera. The ease of normal activities of the animals was also considered as one of the measurement outcomes.

Statistical analysis of infrared thermal imaging data revealed a highly significant ($p<0.0001$) effect due to wearing the IceWave® Patches in the affected (painful) areas in all horses with a statistical power of 100%. Statistical analysis of acupuncture palpation data as assessed by the veterinarian based on the 1-10 point pain scale also revealed a highly significant ($p<0.0001$) reduction in pain level due to wearing the IceWave® Patches in the affected (painful) areas in all horses with a statistical power of 100%. This result further confirmed that there was excellent overall agreement between the experiential acupuncture palpation method used by the veterinarian in her clinical practice as a subjective measure of pain evaluation and infrared thermal imaging data as an objective measure of pain. Based upon these findings the data clearly reveals the IceWave® Patches produce a highly significant cooling effect (pain reduction) in the areas affected by pain in horses. It was also observed that the IceWave® Patches exert a warming effect due to increased perfusion in hypothermic (cold) areas affected by abnormal circulation.

Introduction

Chronic musculoskeletal pain could consist of categories such as chronic low back pain, non-inflammatory arthritis (e.g., osteoarthritis), inflammatory arthritis (e.g., rheumatoid arthritis), fibromyalgia, myofacial pain syndrome and others. Chronic pain treatments include Transcutaneous Electrical Nerve Stimulation (TENS), acupuncture, ultrasound, thermal therapies, lasers, and drugs such as antidepressants, Non-Steroidal Anti-inflammatory Drugs (NSAIDs), opioids, and other medications1 [1. Tan, 2005]. Drug-free pain relief and management offer tremendous advantages over drug-based approaches mainly due to lack of side effect complications and as such are of considerable interest in the treatment of humans and in veterinary medicine.

Infrared thermal imaging, also known in the literature as medical infrared thermal imaging is a non-invasive diagnostic imaging procedure, which detects and records surface skin temperatures by measuring the variations in heat that is spontaneously emitted from body surfaces. Since heat dissipation through the surface skin is mainly in the form of infrared radiation, infrared thermal imaging offers an effective way to study the physiology of thermoregulation and the thermal dysfunction associated with *pain*[2,3]. It is well established that patterns of surface skin temperature distribution in a healthy body shows a bilateral symmetry[4]. Asymmetrical patterns in skin temperature

distribution may be strong indication of pathology[5-7]. It is also established that changes of temperature distribution in the skin are related to some nociceptive and most neuropathic pain pathologies, which manifest as hyperthermic or hypothermic regions[8]. Thermal measurements reflecting surface skin temperature distribution are converted into live images visualizing the autonomic nervous system thermoregulating activity. Therefore, changes in the neurological and musculoskeletal system influenced by trauma or dysfunction could then be detected, monitored and *quantified*[3]. It is a useful approach in detecting the origin and extent of chronic and acute pain.

As the autonomic nervous system of the body controls the thermal response, the external skin temperature creates a thermal map that is an *objective* measure of normal as well as abnormal physiologic function. The infrared evaluation as a diagnostic procedure in evaluating normal physiologic function can be an accurate and objective evaluation of pain. In thermal skin readings, a 0.05 °C difference is considered significant[9].

As infrared thermal imaging does not use ionizing radiation (no energy is used to excite the body and it only involves measuring the infrared radiation emanating from the surface skin) it is considered as 100% safe and does not suffer from any side effects like other imaging modalities do. Whereas X-rays demonstrate anatomy, thermal imaging is unique in its capability to show *physiological change and metabolic processes*. It has also been proven to be a very useful complementary procedure[10,11] to standard investigations based on X-rays and other 3-dimensional diagnostic scanning techniques such as Computerized Tomography (CT) and Magnetic Resonance Imaging (MRI). With recent advancements in infrared technology, intelligent image processing and enhancement algorithms as well as pathophysiological-based understanding, this imaging modality has emerged as a non-destructive, cost-effective and patient-friendly approach to health monitoring, examination and diagnosis.

The first applications of infrared thermal imaging in diagnostic medicine occurred in 1960's with breast cancer detection as the primary practice[12,13]. Since then, it has been applied to a variety of conditions including nerve root impairment[7], back and neck injuries[8], peripheral neuropathy[14], migraines[15], inflammation[16], complex pain syndromes[17], cervical sprains[18], shoulder impingement syndrome[19], and fibromyalgia[20] to name a few. Also a number of investigations have shown that infrared thermal imaging is a sensitive, accurate, and practical aid in the clinical evaluation of a variety of conditions in the equine patient.[21-31]

In a recent clinical study the efficacy of infrared thermal imaging in distinguishing response to true acupuncture treatment was investigated. It was demonstrated that infrared thermal imaging is a reliable and easy to use tool to distinguish between true acupuncture points and non-acupuncture points.[32]

IceWave® Patches are referred to by their manufacturer as an acupuncture product for mild stimulation of *acupuncture points* without the needle. These Patches are made of a mixture of patent-pending amino acids, sugars, water, oxygen, and organics applied to a polyester substrate and sealed inside a polymer shell. The top side of the Patch is composed of water-resistant polyethylene film sealed to the bottom portion that is composed of water-resistant single coated medical-grade polyethylene tape. The bottom side of the medical-grade polyethylene tape that attaches the white and tan Patches to the body is coated with a hypoallergenic pressure sensitive acrylate adhesive made by the 3M Company that allows the Patch to adhere to the body. The Patches are disposable wearable devices that utilize body heat to reflect back specific infrared signals (a narrowband portion of the body heat). back into the body. They are applied to acupuncture points for optimal transfer of reflected heat back to the body and mild stimulation of acupuncture points. The IceWave® Patches are designed to be used together as a pair. The white Patch is applied to the right side of the body and the tan Patch is applied to the left side. Because of the nature of construction none of the organic materials in the Patches enter into the body making the IceWave® device a *non-transdermal Patch system*.[33, 34]

In 2005, an initial study was carried out in 142 horses[35]. It was demonstrated that horses responded dramatically to LifeWave® Energy Patches. In that study, 137 out of 138 horses with mild to severe back pain, responded favorably and showed consistent pain relief manifesting more energy and power. That study proved that alternate (drug-free) treatment benefits were possible without harmful effects. It was further evident that these Patches might well be causing a measurable physiological effect to reduce pain and inflammation and therefore enable the body to heal itself more quickly. The current study was then designed to explore these possibilities. Other published double-blind placebo-controlled studies in humans have also demonstrated a skin cooling effect or parasympathetic response elicited by these Patches.[36-38]

Since animals cannot communicate in words, it is sometimes difficult for caretakers to identify painful areas in the body. Acupuncture evaluation and *palpation* of anatomical areas has been a great tool to help identify problems in the horse for further examination and treatment[39].

Infrared thermal imaging is proving to be an accurate and sensitive method to identify those issues even more precisely and was incorporated into this study to further validate the findings based on acupuncture theory and palpation. The standard approach for pain relief in

horses can involve anti-inflammatory drugs and chemical pain relievers. These can of course, be effective. Drugs, however, cannot be used in most horse events, racing, or in shows, and if pain relief can be accomplished in a more natural way, that involves no harmful effects in the short or long term, we are far ahead.

The main objective of the present study was to follow up on the initial study in horses and use infrared thermal imaging to quantify the efficacy of IceWave® Patches in pain relief and management. Thermal measurements and imaging were complemented with acupuncture palpation evaluations performed by the veterinarian. It was also of interest to explore the effects of these Patches on painful and inflamed areas in horses and demonstrate their physiological cooling impact and further cross-validate with the veterinarian's expert assessments. The study design to be tested was that: IceWave® Patches produce a highly significant cooling effect (pain reduction) in the areas affected by pain in horses.

Materials and Methods

A total of 38 horses, 1 stallion, 25 geldings and 12 mares, and of varying ages, 5 to 30 years old, and disciplines, were examined and owners were consulted about study suitability. Three horses were considered elderly, at 28, 29, and 30 years of age. Any obvious problems that the owner was aware of were noted. Any horses that were on medication were removed from all medications 24 hours prior to the study. Any horses currently under treatment for serious conditions, such as advanced Cushings' disease or post-surgical treatments were not deemed suitable and were excluded from participation.

The study was carried out at the veterinarian's facility at Coffman Ranch in Clovis California in February 2010. Several horses participating in the study resided at this facility and the rest were brought in by their owners. The horses were taken right from their trailers and placed in holding stalls or held by the owner. Precautions were taken to ensure all horses enrolled in the study were kept calm and were maximally comfortable with the barn area where the study was conducted. None of the horses were upset, distressed or required special restraints.

Owners were asked to help visualize and palpate the areas on the neck, shoulders, back and hindquarters of their horse. If the horse had chronic problems with various other conditions, such as pain in the feet or legs, those were also noted. We did not concentrate on those abnormalities. This method of palpation aided in determining what region of the horse's body to image first, in order to determine the greatest source of pain. The resolution of the infrared imaging system used in this study was 0.01 degree centigrade (C).

Infrared thermal imaging data as well as acupuncture palpation data from 38 horses were acquired by veterinarian and the chiropractor members of the team. The chiropractor is board certified in Infrared Thermal Imaging and has been using infrared imaging as a diagnostic tool for chiropractic pain applications for years. Infrared thermal imaging measurements were repeated between 4 to 10 times in each horse. These measurements provided a total of 165 data points in 38 horses.

Infrared Thermal Imaging was conducted in a temperature-controlled draft-free environment where the ambient air temperature averaged 48 degrees F° (~ 8.9°C using the following conversion formula: F = 32 + 1.8 C). Great care was taken to position the horses the same distance from the camera in each image sequence, especially when imaged the second time. All the horses were patched by the veterinarian and chiropractor members of the research team with the tan Patch on the left side and the white Patch on the right side. The patches were applied in pairs based upon the most obvious thermal and changes observed on the images, and the most palpable regions. Several acupuncture points were found, which based on the observed thermal changes were not limited to the immediate local area, but with respect to the rest of the horse as well, created a much broader physiological response was observed. These points were Bladder 13 (Association Point for the Lung Meridian and located 3 body inches lateral to the lower border of the spinous process of the eighth thoracic vertebra); Bladder 23 (Association Point of the Kidney Meridian and is found three body inches lateral to the lower border of the spinous process of the lumbar vertebra between the second and third lumbar vertebra straight above the end of the last rib); and Bladder 28 (Association Point for the Bladder Meridian three body inches lateral to the lower border of the sacral spinous process between the foramen of the second and third sacral vertebrae).[39] Figure 1 shows examples of Patch application on the horses. The horses were imaged before patching and, utilizing the most affected areas on the images, the patches were placed for each case. Each horse was treated as an individual.

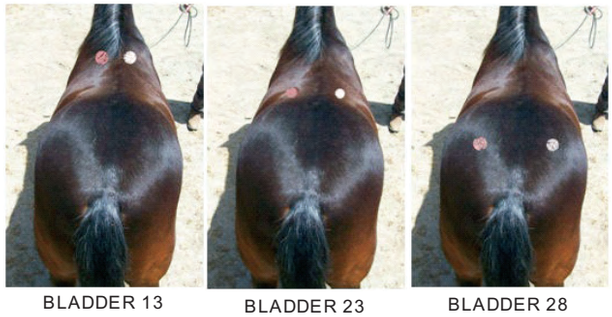

Figure 1. Examples of Patch application on specific acupuncture points on the body of the horse.

The veterinarian palpated specific areas of the horses that were most commonly painful in performance and in older pet horses. The neck, base of neck, shoulders, back and croup were examined and palpated with about 3 pounds of pressure. A 10-point pain scale also used in the initial study was adopted for the current study[34]. The veterinarian trained the owners to identify and gauge the painful areas. Owners were helped to visualize and palpate the areas on the neck, shoulders, back and hindquarters. If the horse had chronic problems with various conditions, such as pain in the feet or legs, those were also noted. However, those areas were not concentrated upon in this study. Figure 2 shows the 10-point pain scale used in this study.

	Subclinical Discomfort
1	no detectable discomfort
2	marginal discomfort with no muscle tightness; skin may twitch in one or two areas
3	slight or localized muscle tightness; skin may twitch in one or two areas
	Mild to Moderate Discomfort
4	marginal sensitivity; twitching of skin in three or more areas or slight tendency of horse to move away from pressure in two or more areas
5	noticeable discomfort and generalized muscle tightness; moves away from pressure but is not terribly distressed
	Frank Distress and Pain
6	mild distress; skin twitches and moves away from palpation; may turn to look at tester and lay ears back
7	obvious distress; may observe muscle spasms over back muscles; may turn to look at tester, lay ears back, stomp foot, and deliberately move away
8	frank pain; may grind teeth, lay ears back, threaten tester, try to get away from palpation; muscle spasms along the back common
	Severe Pain
9	may not tolerate even a light touch; may drop and fall away somewhat from the hand when palpated
10	may try to kick or bite; drops noticeably when palpated over the croup area

Figure 2. The 10-point pain scale used by the veterinarian to subjectively evaluate the level of pain by palpation in the horses.

It should be emphasized that palpation for painful responses in horses in not a diagnostic tool in itself, but must be supported by other methods of detection such as radiographs, sonograms, thermal imaging, and conventional lameness exams. However, the veterinarian uses acupuncture palpation in her practice as an indicator for further investigation. Variations in breeds of horses, individual disposition and sensitivity, can create variable palpatory findings. Acupuncture palpation served as a useful complimentary method in evaluation of the results of the application of IceWave® Patches on acupuncture points, before and after patching. The patches were applied in pairs according to the most obvious positions seen on the images (for example, please see Figure 1 above), though at the end we found several points, which seemed to be the most effective and seemed to cool not only the immediate area but other areas as well.

Results

Study subjects with pain symptoms had their area of pain scanned with an infrared thermal imaging system. Horses were scanned bilaterally before and after the patches were applied. . The infrared imaging system used in this study measured thermal differences to a 0.01 of a degree C.

Table 1 shows the Horse Name, Average Pre-patch, Average post-patch, ?T oC (temperature drop or cooling effect after patch application), % reduction in temperature (effect size or response rate and Response Rank in 38 horses. The average temperature measured in all horses in the areas before patch application was 28.47 oC and after patch application was 24.34 oC showing an average reduction of 4.13o C. The average standard deviation of the measured temperature before patch application was 1.365 oC and after patch application was 1.913 oC. The range of % temperature reduction (effect size or response rate or cooling effect) was 24%-7.2% with an average value of 14.5%.

The thermal imaging data demonstrated that all horses responded well to wearing the IceWave® Patches by showing a consistent reduction of temperature (cooling effect) in the areas bracketed by the IceWave® Patches. The effect size (cooling effect or reduction of temperature) was calculated as the difference between temperature before and after application of the IceWave® Patches. The % reduction was then calculated as the effect size divided by the temperature before wearing the IceWave® Patches multiplied by 100%. The table shows the names of the horses, the % reduction of their temperature (cooling effect) in the areas under the influence of the IceWave® Patches and ranking according to response rate. This means that the horse named Center showed the highest response (24%) to wearing the IceWave® Patches and Annie showed the lowest response (7%) to wearing the patches.

Horse name	Average Pre-patch Temp. (°C)	Average Post-patch Temp. (°C)	ΔT °C	% Reduction in T (Effect size or **response rate**)	Response Rank
Center	24.73	18.78	5.95	24.05	1
Hawkeye	28.93	22.17	6.76	23.37	2
Sugar	29.18	22.65	6.53	22.38	3
Kodak	29.23	23.21	6.02	20.60	4
Joe	29.61	23.55	6.06	20.47	5
Reining	29.46	23.55	5.91	20.06	6
Tesoro	26.40	21.13	5.27	19.96	7
Neo	30.23	24.47	5.76	19.05	8
Sassy	29.47	24.19	5.28	17.92	9
Paradise	28.86	24.02	4.84	16.78	10
Tolemac	26.30	21.92	4.38	16.65	11
Annabelle	26.49	22.28	4.21	15.89	12
Maggie	29.31	24.65	4.66	15.90	13
Hurley	27.43	23.18	4.25	15.49	14
Reina	28.04	23.73	4.31	15.37	15
Sugar Bueno	28.98	24.56	4.42	15.25	16
Red	29.54	25.15	4.39	14.86	17
Frosty Star Chex	27.00	22.97	4.03	14.93	18
Moody	27.95	23.95	4.00	14.31	19
Shadow	30.12	25.88	4.24	14.08	20
Munoso	27.21	23.46	3.75	13.78	21
Tez	28.51	24.65	3.86	13.54	22
Sassy Z	29.96	25.91	4.05	13.52	23
Scarlet	28.46	24.68	3.78	13.28	24
Ripley	28.08	24.40	3.68	13.10	25
Comanche	28.33	24.65	3.68	12.99	26
Casper	27.10	23.63	3.47	12.80	27
Lena	29.90	26.08	3.82	12.78	28
Sammy	29.41	25.83	3.58	12.17	29

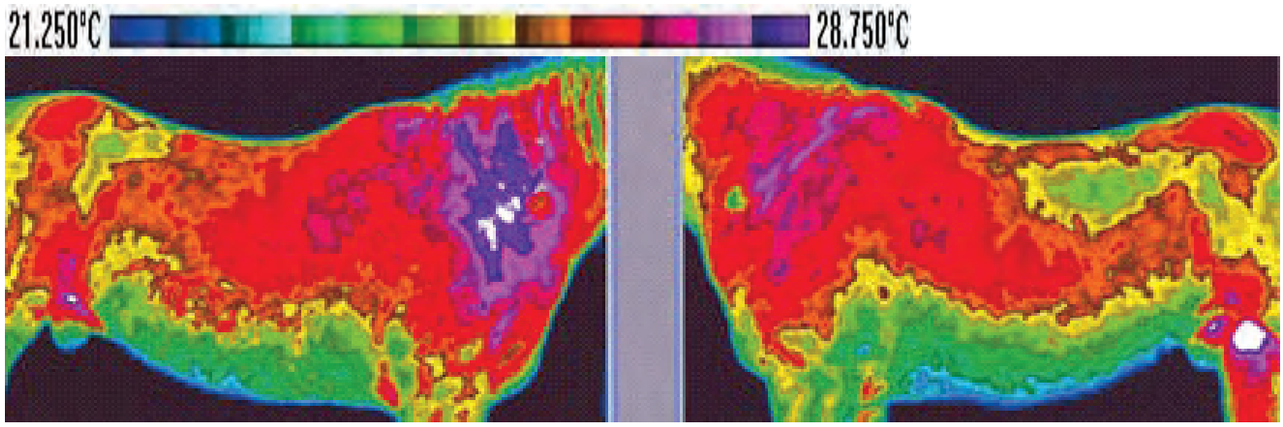

Figure 3a. Infrared thermal image taken of Hawkeye before applying the IceWave® Patches.

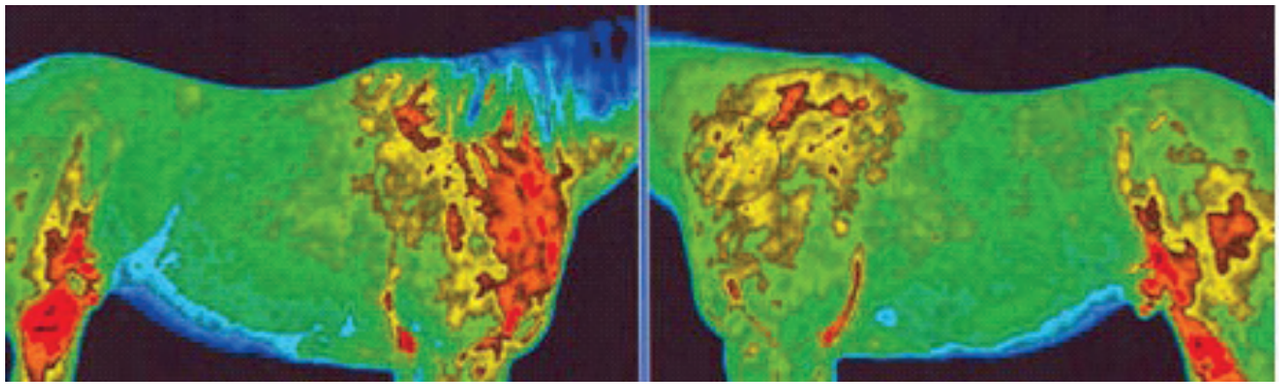

Figure 3b. Infrared thermal image taken from Hawkeye 10 minutes after applying the IceWave® Patches.

Figure 3 shows infrared thermal images pre- and post-patch application from Hawkeye ranked 2 in response as an example. The post-patch application image was captured 10 minutes after applying the Patches.

This infrared series reveals the two sides of the horse and how the thermal difference is very clear on the right side of the horse with great change noted to the right shoulder and neck regions. There is a thermal change noted on the left side of the horse with slight change noted to the left shoulder and lateral side of the horse.

After the patches were applied to the bladder 13 acupuncture point (is the Association point for the Lung Meridian and located 3 body inches lateral to the lower border of the spinous process of the eighth thoracic vertebra) the thermal change is obvious in the lower pictures. The entire body cooled and the intense hot thermal regions cooled.

Acupuncture palpation data also showed that overall horses responded well to wearing the IceWave® Patches and exhibited a consistent reduction in the pain scale point used by the veterinarian to estimate their

Table 2. Horse Name, Location of Pain and Patch Application, Pain Level before IceWave® Patch Application (Pre-patch), and Pain Level after IceWave® Patch Application (Post-patch). The following abbreviations were used:
N = neck, BN = base of neck, S = shoulder, MB = mid back, H=hip, croup. No = None observed

Horse name	**Location of Pain and Patch**	**Pain Level (before) IceWave® Application**	**Pain Level (after) IceWave® Application**
Center	MB	2-4	1
Hawkeye	N,BN,S,MB,H	8-10	2-3
Sugar	N,BN,S,MB,H	8-10	1
Kodak	N,BN,S,MB,H	8-10	1
Joe	No	1	1
Sabine	S,H	3-4	1
Tesoro	No	1	1
Neo	MB,H	2-4	1
Sassy	S,H	2-4	1
Paradise	BN	2-4	1
Tolemac	MB,H	2-4	1
Anabelle	BN	1-2	1
Maggie	N,BN,S,H	9-10	2-3
Harley	N,BN,H	3-4	1
Reina	N,BN,S,H	9-10	1
Sugar Bueno	BN,S,MB,H	6-7	1
Red	N,BN,S,MB,H	8-10	1
Frosty Star Chex	N,BN,H	2-4	1
Moody	N,BN,S,MB,H	7-8	1
Shadow	N,BN,S	2-4	1
Munoso	No	1	1
Tez	S,BN	5-7	1
Sassy Z	S,H	2-4	1
Scarlet	S,H	2-4	1
Rippley	S,H	5-7	1
Comanche	S,H	2-4	1
Casper	S	8-9	1
Lena	BN,H	4-5	1
Sammy	S,H	2-4	1
Lincoln	S,H	2-5	1
Cue	S,H	2-4	1-2
Luke	S	2-4	1
Dusty	N,BN,S,H	5-7	1
Jesse	No	1	1
Beau	N,BN,S,MB,H	6-7	1
Bandit	BN,S,H	2-4	1
Tina	S,BN,MB	7-8	1
Annie	BN,S,H	7-8	1

pain level. The overall mean pain level as assessed by acupuncture palpation of painful areas by the veterinarian in all horses before IceWave® patch application was at a *mild to moderate discomfort* level (ranging *from no detectable discomfort* to *not being able to tolerate the lightest touch and may fall*) quantified to 4.58 (on a scale of 1-10). The overall mean pain level assessed after IceWave® patch application was at *no pain* level (ranging from *no detectable pain* to *marginal discomfort with no muscle pai*n) quantified to 1.31 (on a scale of 1-10). This showed a reduction of 3.26 in pain level (a mean value >70%). The average standard deviation of the estimated pain level before IceWave® patch application was ?2.65 and after IceWave® patch application was ?0.47. The quantified range of pain reduction as estimated by acupuncture palpation was between 0%-89%.

Statistical analysis of thermal imaging data revealed a highly significant ($p<0.0001$) effect due to wearing the IceWave® Patches in the affected (painful) areas in all horses with a statistical power of 100%. Statistical analysis of acupuncture palpation data as assessed by the Veterinarian based on the 1-10 point pain scale also revealed a highly significant ($p<0.0001$) reduction in pain level due to wearing the IceWave® Patches in the affected (painful) areas in all horses with a statistical power of 100%. This result further confirmed that there was excellent overall agreement between the experiential acupuncture palpation method used by the Veterinarian in her clinical practice as a subjective measure of pain evaluation and infrared thermal imaging data as an objective measure of pain. Based upon these findings the study design proved that *IceWave® Patches produce a highly significant cooling effect (pain reduction) in the areas affected by pain in horses*. It was also observed that the Patches exert a warming effect due to increased perfusion in *hypothermic (cold)* areas affected by abnormal circulation.

Discussion

Five horses were not found to have any detectable pain, nor did the owners know about any obvious problems. All but one of these horses has been under treatment by the veterinarian for previous problems, but had been working well for some time. Several other animals have been the Veterinarian's patients but still had some residual problems with pain in some isolated areas. Four horses had severe pain from previous injuries, and had positive results. One older horse had severe pain from arthritis and was retired, however had a very positive result from the patching. The majority of the horses were in use and active in their discipline to various degrees.

The correlation of the imaging with the patching was truly remarkable. The feedback from owners on many of the horses consistently showed two things. Owners were in general not able to palpate painful areas at all after their horses were patched, nor 24 hours after. Some even remarked that their horses were more comfortable being groomed. Several had performance improvement immediately and for several days after the patching. Many that responded noted that their horses were moving more freely and were mentally more relaxed than they had been. The old horse that was having a mobility problem stopped leaning up against the barn to prop himself up while eating.

The horse that had been injured in the shoulder was an interesting case. He actually appeared to the owner to have increased pain the following day. However, that is not necessarily alarming because the body responds to healing processes in different ways. Two days after the patching, the owner noticed this same horse galloping across her pasture and stated that he hadn't done that in months before his injury. This horse was examined by the Veterinarian several days later, and he showed only very mild sensitivity in his injured shoulder. While that particular horse has issues in his feet, which are a work in progress, the Veterinarian saw some definite progression of healing in the injured shoulder.

There was one horse, which was literally in the middle of a lesson when he came up to be imaged. He was a new horse for this owner and had not been seen by the Veterinarian. He had multiple painful areas, was very agitated in his lesson work, and there was a definite potential for bucking the rider off. After the patching, he was a different horse. He was much more calm and relaxed. His back did not hurt and the lesson went on with a completely different tone.

When 3 to 5 minutes had elapsed, most of the horses dropped their head and started licking and chewing. This is consistent behavior in a horse that indicates relaxation and comfort. This is observed by all people who have worked with horses everywhere and was interpreted as a sign that the patches had begun to exert their effect.

Ten minutes elapsed before the horses were re-imaged and re-palpated for painful responses. During this ten-minute period, the horses were all content to remain quietly in the imaging area. The horses were again palpated with the participation of the owners in the same places. The difference in palpatory findings was consistent in all the previously painful areas. Every horse palpated with little to mild discomfort. Palpatory findings were ranked on a 1 (no detectable discomfort) to 10 (may try to kick or bite…) scale. Most of the horses were between 1-3 on this scale after patching.

The horses' owners then were directed to leave the patches on for at least 24 hours and prepare to offer a report of finding or changes in the horses' behavior or performance to the Veterinarian. Horses that were boarded at Coffman Ranch were personally examined by the Veterinarian after 24 hours. Assessments were

Figure 4. Hawkeye, in front, running with his white pair of IceWave® patches applied on his right side.

different for each individual horse and the particular activities the horse normally performed.

Most owners could not elicit pain from the areas that had been affected prior to patching, and many had positive comments about the horses' behavior, calmness, and clear positive benefits to their performance. The owners were surveyed on what changes they observed or palpated in the horses' health or attitude. Each horse was treated as an individual. The most prominent patch placements were Bladder 13, Bladder 23 and Bladder 28 as noted on the common equine acupressure charts[39]. It was noted that the majority of the horse population had shoulder and lower neck abnormalities as observed in the infrared scans and through palpation. Hawkeye was a remarkable example. Hawkeye stopped the leaning behavior the same day after patching and was standing by himself. In fact, he has been patched regularly since the study and the owners are thrilled with his continual improvement and regained zest for life. The picture in Figure 4 was sent 3 months after Hawkeye participated in the study.. The owner has been using the patches regularly in several points as explained in other references (The application points when pictures were taken were Bladder 23 and LI 16 as explained in Veterinarian's e-books available on line. www.drderock.com The position of application of white patch pair for Hawkeye is shown in the image below (right side). Please note that the tan patch pair is applied on symmetrical anatomical positions on the left side of the horse. There are many, many useful and powerful acupressure points that can be used to advantage.

The most remarkable case study came from a horse named Munoso, a 6-yr-old Spanish Mustang gelding who had been in training off the owner's property and had had a back injury during the time he was caught under a fence. There was no veterinary care at that time, but when the horse came home the owner noticed that he was very emotionally disturbed. He was very fearful, jumped at every noise, and after several weeks there was no improvement. She stated that this was very uncharacteristic of this horse. He had no significantly palpable painful areas. When the horse was imaged, we saw not only inflammation in the shoulder area, but a black area, which indicates a hypothermic (cold) region, and could be caused by lack of circulation from such an injury. It was dramatically palpable and felt like someone had been holding an ice pack on his side for hours. Two sets of patches were used on the back. They were applied adjacent to the cold area: white on right, tan on left. In ten minutes, the shoulder had cooled

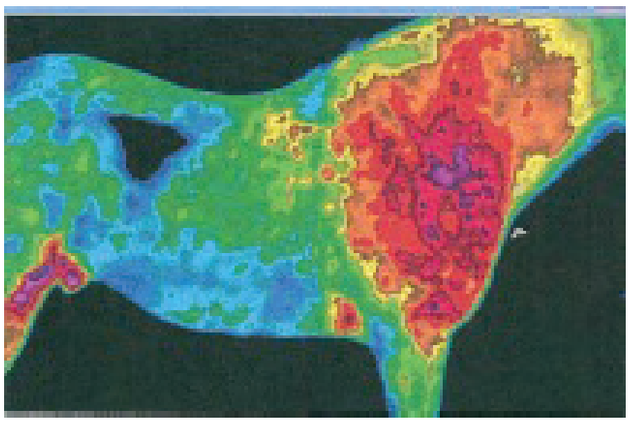

Figure 5a: Mancuso's right side before patches

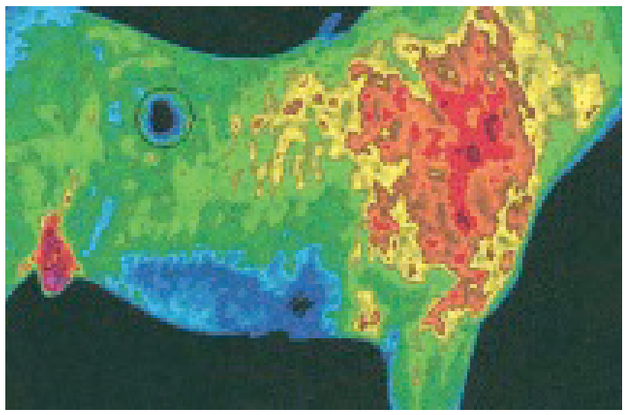

Figure 5b. Munoso's right side ten minutes after patches were applied.

dramatically; but more importantly, the cold area was reducing in size. This showed that the patches were not only effective in cooling a warm area, but also could warm a cold area due to lack of bloodperfusion or circulation. Figures 5a and 5b show Munoso right side before and ten minutes after patch application, respectively.

Munoso's owner had illness and other personal problems so the horse was not evaluated by the veterinarian again for several weeks. effects of the initial patch application used in the study. When he was examined, he no longer had a cold area and the owner said he had calmed down considerably, but the owner had not been able to pay much attention to him nor treat him with patches. This is an example of the longer term effects of the initial patch applcation used in the study.

Conclusion

This study was designed to be as objective as possible. The results were beyond anything we could have expected. After trying various placements, we settled on the three points that seemed to be particularly effective in many areas as shown on the images. The study was designed to prove there was a measureable physiological effect from the application of the patches. There are many hundreds of points that could have been used. The results of this investigation are very significant and provide a useful discovery for the people who use the patches on their horses. The relief in some of the horses' performance and function was exceptional. The owners gave great feedback for many of the horses. IceWave® Patches provide an effective, simple, and drug-free means to reduce pain and help horse owners with a safe, self-administered pain management option of their animals.

The Lifewave® Patches produced a highly significant cooling effect in the areas affected by pain in horses of varying ages and breeds. We were very pleased with the positive feedback from most of the horse owners. They noticed changes in their horses, in some, very profound positive changes and better attitude. Almost all of the owners mentioned that their horses were calmer and seemed happier the next day. The IceWave® technology promises to have a very profound effect in helping horses with their every day aches, pains and distress. This drug-free pain management too will improve performance in many cases and seems to give very elderly horses greater energy and relief from painful conditions.

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