Use of Thermography in Lameness Evaluation

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Thermography is a practical aid in the clinical evaluation of lameness. This modality specifically increases the accuracy of a diagnosis for upper limb lameness by confirming inflammation in palpably sore areas and by showing the area to concentrate further diagnostic testing such as sonography, radiography, or muscle biopsy. Author’s address: Dept. of Clinical and Population Sciences, University of Minnesota, 1365 Gortner Ave., St. Paul, MN 55108. © 1998 AAEP.

1. Introduction
A lameness diagnosis can be very frustrating when the source of the pain is located in the upper leg and is not associated with a synovial structure, when the lameness is too subtle to utilize diagnostic analgesic injections, when the patient is not amenable to these injections, or when the lameness is difficult to eliminate by local analgesic injection. These cases usually require the practitioner to treat the horse symptomatically or to perform other diagnostic techniques to try to determine possible areas of injury.

Thermography is one such technique. It is the pictorial representation of the surface temperature of an object. It is a noninvasive technique that measures emitted heat. A medical thermogram represents the surface temperatures of skin, making it useful for the detection of inflammation. Although thermographic images measure only skin temperature, they also reflect alterations in the circulation of deeper tissues. This ability to assess inflammatory change noninvasively makes thermography an ideal imaging tool to aid in the diagnosis of certain lameness conditions in the horse. The purpose of this paper is to describe the use of thermography as an aid to a clinical lameness diagnosis.

2. Materials and Methods
Records from 254 cases of lameness presented from 1993 through 1997 to the University of Minnesota were used to characterize the types of cases in which thermography was useful, to assess the usefulness of the instrument, and to characterize the most common thermographic patterns associated with lameness of the horse.

A Flir IQ325 thermographic camera was used to collect the information. Images were made at right angles to the region of interest. The thermal range was set at 10°C with ten levels of demarcation. This meant that each color change was equivalent to 1°C. Significant thermal differences were seen when a right-to-left temperature asymmetry of 1°C or more was noted over 25% of comparable areas.¹

3. Results
Thermography was most commonly used to evaluate horses with back or hindlimb lameness, i.e., 151 of 254 cases (59%). The second most common use of thermography was to evaluate the horse for performance or prepurchase, i.e., 58 of 254 cases (23%). In this capacity, the horses were examined to determine if any area of inflammation could be detected that would account for decreased performance or
determine a source of pain that might explain a horse's change in attitude toward work or to try to identify subclinical areas of inflammation. Thermography was used least frequently for the investigation of forelimb problems, i.e., 45 of 254 cases (18%). Thermography provided significant information in 218 of the 254 horses (86%) examined. Temperature changes were identified as either hot spots or cold spots. The thermographic image was very useful in localizing the area of injury but did not characterize the specific nature or etiology of the injury. An investigation of the upper limb lameness was the region where thermography was the most useful; of the 254 horses examined, 152 had thermographic evidence of upper limb injury. The most frequent upper limb problems were located over large muscle masses and thought to be either muscle strains or muscle inflammation. In the upper forelimb, the most common areas of temperature asymmetry were located over the pectoralis muscles or the biceps brachii. Most horses with the pectoralis injury were grade II-III/V lame and would typically show increased pain with limb abduction. The lameness of horses with injuries of the biceps were grade II-IV/V, characterized by a noticeably shortened anterior phase of stride and in which pain usually could be elicited over the point of the shoulder. In those cases showing increased heat over the bicipital region, we were able to identify specific lesions within the biceps tendon or bicipital bursa by utilizing ultrasonography.

In the upper hind leg, abnormal thermal patterns of three distinct regions were commonly seen: cranial thigh, caudal thigh, and croup region. In the cranial thigh, distinct hot spots were associated with the quadriceps musculature just proximal to the insertion on the patella. In each of these cases, we have been able to subsequently find evidence of muscle damage by utilizing ultrasonography. The caudal thigh thermography showed several common areas of abnormal heat. The most common was at the musculotendinous junction of the semitendinosus muscle. A third area of abnormal thermal patterns was commonly seen in the caudal thigh, just caudal to the third trochanter of the femur directly over the biceps femoris. These horses typically presented with grade III/V lameness or worse, and there was intense pain associated with pressure over this region. The thermal changes noted were both a hot spot and an intense cold spot. We have not correlated any sonographic findings with this injury to date. The croup area injuries involved hot spots over the loin region, over the sacroiliac region, over the body of the gluteal muscle, and over the third trochanter. Ultrasonography has been used in these cases to characterize a muscle cramp (increased echogenicity over the area as compared with the opposite side), dorsal spinous ligament desmitis, and suspect sacroiliac desmitis. Fasciitis was diagnosed in one case based on muscle biopsy. In the assessment of horses that tie up, thermography indicated that the longissimus and gluteal muscle regions had the most intense heat. Further, the behavior the horse showed during the tying-up episode correlated with the thermal patterns. Horses that became stiff showed the most intense heat over the longissimus muscles, whereas horses that would stop and be very reluctant to move showed the most intense heat over the gluteal region.

4. Discussion
Thermography specifically increases the accuracy of a diagnosis by confirming inflammation in palpably sore areas and by providing objective data that indicate which area to concentrate further diagnostic testing, such as sonography, radiography, or muscle biopsy. Heat is one of the cardinal signs of inflammation and is associated with a thermographic hot spot. Cold spots, however, may also be a sign of injury and reflect the presence of marked swelling that results in decreased circulation in the damaged tissue or the presence of dense scar tissue. Two of the cases of cranial thigh injury were presented for possible patella fracture or luxation because of the prominence and slight lateral deviation of the patella. In each case, the patella was not fractured and the patella was in its normal position. Ultrasonography of the region of the hot spot revealed a disruption of normal muscle fibers and regions of varying sizes of hypoechogenicity typical of hemorrhage. Horses with injury to the caudal thigh typically presented with the hoof slap gait typical of fibrotic myopathy. Sonography of these cases revealed two different types of change, i.e., a hyperechogenicity thought to be early fibrosis and a disruption of normal tendon patterns with focal hypoechogenic areas suggestive of tearing of the musculotendinous junction. These changes were centered over the hot spot. Horses that had hot spots over the croup usually presented with more subtle lameness and complaints of being sore in their backs or stifles. The horses typically traveled short behind, had poor acceptance of the bit, and tended to move in a hollow manner. No consistent sonographic findings were found in these cases; however, evidence of fasciitis was seen on muscle biopsy of one case.

Each of the cases was treated in a method consistent with the diagnosis and clinical findings. Muscle injuries were treated by using a combination of methods. Treatment generally involved changes in training regimes to allow for more stretching of the involved muscles, conditioning and fitness exercise, and nonsteroidal therapy in the first 2 weeks of therapy. In some cases, acupuncture and chiropractic treatments were recommended, as well as massage therapy, therapeutic ultrasound, and electrical stimulation therapy. I am currently examining the
results of such therapy, and so far the results have been very encouraging and support the clinical diagnosis.

5. Conclusions
Thermography, when combined with a thorough clinical examination, is an excellent modality for the assessment of lameness. It is particularly helpful in determining areas of inflammation in the upper limbs but can also be readily used to assess inflammation of the lower limbs. It has been useful in assessing cases of palmar foot pain and has helped to identify areas other than the navicular bone that may be sources of pain. It has been useful in the assessment of joint problems, as well as tendon and ligament problems. Since the modality is noninvasive, it can readily be used, and with recent technological advances the equipment is completely portable and can readily be taken to farms, arenas, and so on.

References