



THE USE OF THERMOGRAPHY IN THE EQUINE PATIENT

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As the expectations for equine athletic performance continue to rise, the physical demands placed upon the musculoskeletal tissues of the horse also increases, and as a result, injury to these tissues is common. Early diagnosis of an injury is critical to the successful treatment and return to function of the equine athlete. Thermography is a non-invasive diagnostic modality that allows the examiner to assess the health of the soft tissues and superficial bones of the horse and aids in early diagnosis of pathology of those structures.

THERMOGRAPHY DEFINED

Thermography is the pictorial representation of the surface temperature of an object. A medical thermogram represents the measured heat emitted from the skin surface of a patient. The skin of an animal is approximately five degrees Centigrade cooler than the core body temperature. Variations in skin temperature result from changes in tissue perfusion and blood flow in superficial veins. The circulatory pattern and relative blood flow dictate the thermal pattern that is the basis for thermographic interpretation. Although thermographic images measure only skin surface temperature (up to five mm in depth), they also reflect alteration of the circulation in deeper tissues and so detect areas of inflammation. Because inflamed tissues have increased circulation, areas of injury will show up thermographically as “hot spots”, unless edema or infarction of the tissues reduces the circulation resulting in “cold spots”.

For thermographic interpretation to be valid, it must be performed in a controlled environment. Factors that must be controlled include patient motion, extraneous radiant energy (sunlight), ambient temperature, and patient hair covering. Motion can be controlled by having a qualified horse handler and using low doses of sedation (other than acepromazine) when needed. To reduce the effects of extraneous sunlight, thermography should be performed in an area of low-level lighting that is shielded from the sun and wind drafts. Ideally, the ambient temperature should be below 86 degrees F (so that the horse does not sweat). Hair length is important since hair insulates the skin and blocks the emission of infrared radiation. As long as the hair is short and uniform in length, accurate thermal images are produced.

Thermographic imaging allows the examiner to determine if symmetrical anatomic structures have similar temperatures at the skin surface. The temperature of a region is reflected as a certain color pattern and this pattern is compared to the same region on the opposite side of the body. A temperature difference of one or more degrees Centigrade between symmetrical regions is considered significant enough to be reflected as a different color on the thermographic image. Multiple thermographic images of a suspect area should be made from at least two views, 90 degrees apart before an area is considered abnormal. Additionally, the examiner must have the knowledge of the normal thermal pattern of the region being examined. Once an area of possible pathology has been identified, the examiner may use additional diagnostic measures such as ultrasonography or radiography to evaluate the region.

CLINICAL APPLICATIONS

Thermography has a wide variety of clinical applications for the horse. Evaluating the tendons and ligaments in the distal limb is one of the most common uses with great potential for preventative applications. Thermal patterns of the normal flexor tendons are bilaterally symmetrical with the lowest temperature centered over the

palmar/plantar aspect of the tendons and the slightly warmer temperature near the fetlock and carpus/hock. Acute tendonitis invariably causes a hot spot over the site of the lesion that can be appreciated on both a PA and lateral view of the limb. Additionally, these hot spots can be detected up to two weeks before physical evidence of swelling, pain, or lameness is clinically observed. This modality has great potential for preventing a debilitating injury by detecting an area of concern before it becomes clinically significant and for this reason is often used in upper levels of competition. Similarly, injuries to the suspensory ligament can be detected allowing for early diagnosis and treatment of this sometimes elusive condition.

Thermographic evaluation of the equine foot aids in the diagnosis and location of such conditions as laminitis, navicular disease, and subsolar or submural abscesses. Laminitis is characterized by inflammation of the laminar structures and therefore an increase in the thermal pattern of the hoof wall. In the patient with navicular syndrome, there is reduced blood flow to the caudal hoof. The normal horse will sustain a half degree Centigrade increase in temperature of the foot after exercise, but most horses with navicular syndrome will not sustain this increase in the caudal foot due to low blood flow. Subsolar or submural abscesses are characterized by focal hot spots at the site of inflammation. More recently, thermography has been used as an aid in evaluating hoof balance. In the imbalanced foot there are areas of disproportionate impact resulting in hot spots on the hoof wall or shoe. By localizing these areas, the farrier and veterinarian are able to correct the imbalance and possibly prevent secondary injuries to the hoof capsule or other soft tissues.

Joint inflammation produces a characteristic increase in the thermal pattern of the overlying skin. The normal joint is typically cool in comparison to the surrounding structures. As a joint becomes inflamed, the thermal pattern changes to an oval area of increased temperature. Because thermal patterns of joints have been shown to change two weeks before the onset of clinical lameness, thermography can assist training and help prevent serious injuries. In the same way thermography is useful in the early diagnosis of stress fractures in the third metacarpal bone, the radius, and the tibia which could prevent catastrophic bone failure.

One of the greatest clinical applications of thermography is for diagnosis of muscle injuries in the upper limbs and back. In the upper forelimb, the pectoralis and biceps brachii musculature are most commonly associated with temperature asymmetry and injury. In the upper hind limb, the distal quadriceps musculature, the semitendinosus and biceps femoris muscles were most commonly isolated as areas of injury and abnormal thermal patterns. Without the aid of thermography, these injuries can be difficult to diagnose. Additionally, injuries of the gluteal musculature, dorsal spinous ligament desmitis and sacroiliac desmitis are often demonstrated as hot spots thermographically. Once a muscle injury is diagnosed with thermography, ultrasonography is used to characterize the lesion.

OTHER APPLICATIONS

Finally, thermography is being used by trainers and owners for the assessment of saddle fit. Both the horse's back and the saddle itself can be imaged after the horse is ridden to show areas of increased contact or lack of contact between the saddle and the back.

Thermography has been shown to be quite useful in lameness diagnosis and evaluation for purchase exams of the equine athlete when used in combination with a thorough clinical exam. Thermography detects heat before it is perceptible clinically and before an area of inflammation results in swelling or pain.

IN CLOSING

Thermography offers several benefits to the equine practitioner. Because this non-invasive diagnostic tool can assess soft tissues and superficial bones, it is quite useful for early diagnosis of injuries of the tendons, ligaments, and feet, as well as the upper limbs and back. Other applications include prepurchase exams and assessment of saddle fit.