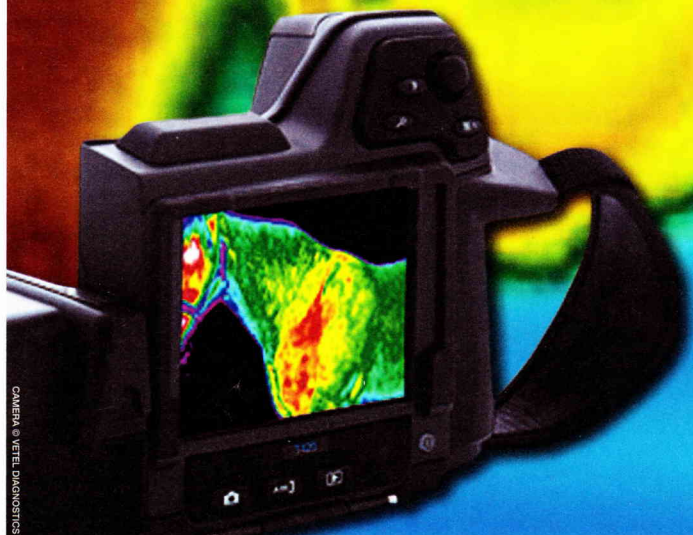


Finally... it's happening! Veterinary medicine is starting to look at performance and working dogs as the athletes that they are.

# Thermal Imaging for the Agility Dog

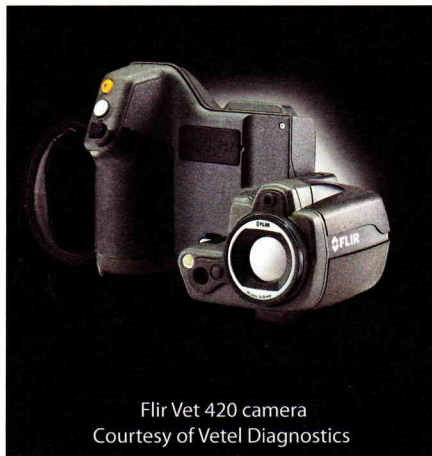
By Kimberly Henneman, DVM, DACVSMR, FAAVA, Dip ABT, CVA, CVC, Diplomate Am College Veterinarian Sports Med & Rehab  
Photos courtesy of author except where noted



In just the past several years, canine sports medicine and rehabilitation research and knowledge has exploded, going from a specialized fringe medicine for only racing sled dogs and Greyhounds to a recognized specialty for all canines, whether hiking weekend warriors or high-level agility dogs. New surgical and rehabilitation techniques have been borrowed and adapted from the human world, as well as developed from scratch to meet the specific needs of the canine athlete. In the diagnostic realm, there are new techniques being used in ultrasonography, MRIs, and force plate analysis—tools with which most canine caretakers are familiar. However, there is one tool starting to grow in use that is not well-known in the canine medical world. It's not a new tool but rather one that expands a technology that has been in use for decades by the military and construction—infrared thermal imaging.

Thermal imaging has actually been around for decades. It is the same type of colorful, tracking imagery seen in the 1987 Arnold Schwarzenegger film "Predator," but it didn't become practical and affordable as a medical tool until the advent of digital technology. Initial analog

cameras were heavy and cumbersome. The camera contained a chamber with spinning mirrors that had to be cooled with liquid nitrogen and had to be attached separately by a cable. Images had to be taken off of a TV monitor screen with a separate camera. Today's cameras are about the size of a large flashlight or SLR camera, use batteries, have wireless data connections, can take real-time video, and store hundreds of detailed, digital images. Additionally, the accompanying software allows post-recording analysis and fine-tuning of temperature ranges to increase detail and definition.



Flir Vet 420 camera  
Courtesy of Vetel Diagnostics

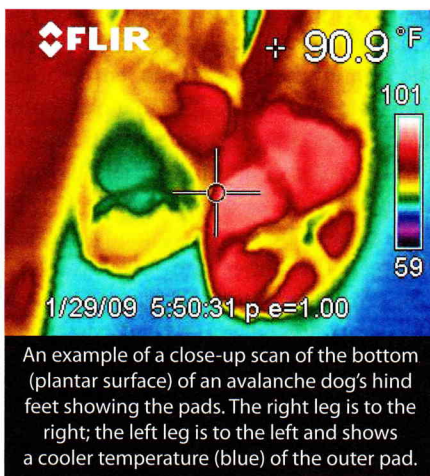
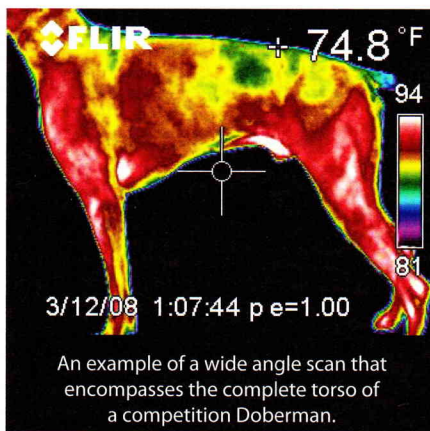
## Benefits of Thermal Imaging

So what does this really mean to the people who work with performance and working dogs? For me, as a veterinarian, it means that I now have a small, efficient tool that fits in a suitcase and can be recharged off of my car battery to identify and monitor *soft tissue* stress, function, and injury. Typically, in veterinary medicine, our imaging diagnostic tools only evaluate structure (x-rays and ultrasound) and then mostly only that of bone with x-rays. Additionally, we can use ultrasound to evaluate the structure, and thus the level of injury or healing, of muscles, tendons, and ligaments. These diagnostic tools, however, are considered *anatomical* or *structural* imaging. In other words, they tell us what the structure is doing but not the function; images will look the same whether the animal (or human) is alive or dead. Thermal imaging, on the other hand, is considered a *physiologic* or *functional* imaging. It is dependent on nerve function affecting blood supply affecting radiated heat (or lack thereof). In the equine world, research (including a new study from the February 1, 2013 issue of the *Journal of the American Veterinary Medical Association*) has shown thermal



imaging to be a valid and effective diagnostic tool in not only identifying injuries before they get to a crisis stage, but also injuries not obvious to the examiner (due to masking by another injury). Both the human medical and wildlife worlds have been successfully finding uses for the technology as well.

Today's thermal imaging cameras, with their variety of lenses, can scan the entire dog down to a single toe. Dealing with the *whole* dog not only can make sure that you are really getting to the injury efficiently, but it can also ensure that any compensations that could affect performance later are addressed *before* they have a chance to cause problems. In the hands of someone who really understands movement mechanics and structure relationships, using thermal imaging to monitor recovery after an injury can also help tailor rehab and training regimes to make sure that tissues aren't being stressed too early. Monitoring tissue's temperature responses to work can make sure that conditioning is moving at a pace that is appropriate for that particular animal's recovery.



## The Thermal Imaging Procedure

In the hands of a veterinarian or a properly-trained thermographic technician, thermal imaging is simple to perform, full of information and noninvasive. Currently Vetel Diagnostics in San Luis Obispo ([www.veteldiagnostics.com](http://www.veteldiagnostics.com)) is the only veterinary training recognized by the American Association of Thermology and the only provider offering canine training. The majority of dogs have no problems with the procedure, although a few don't like the reflection of the lens (or simply just don't like having a veterinarian behind them—go figure). The entire dog, including feet, legs, groin, head and back, can usually be scanned in less than 20 minutes. If a scan is performed by a thermographic technician, the images can only be interpreted by a licensed veterinarian. If there are concerns about movement stresses versus postural or standing stresses, the dog can be put on a treadmill and videoed with the thermal camera. This allows evaluation of soft tissue over a set period of controlled movement. It is important to note that thermal imaging is not meant to be a replacement for a good physical exam and it is at its best usefulness integrated into

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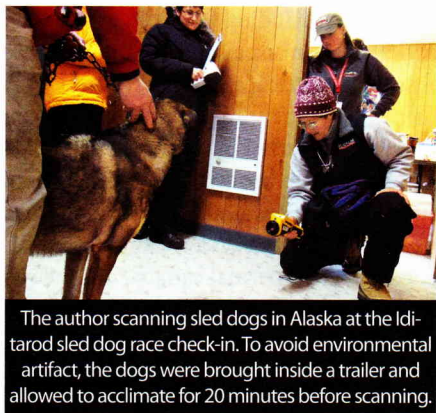
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a complete exam that may include anatomical imaging such as x-rays or ultrasound.

Because thermal imaging is measuring heat given off by an animal, control of environmental factors (wind, rain, sun) that could create mistakes (or artifacts) must be managed; something that is well-understood and can be worked around by someone with appropriate understanding of the equipment. I have been able to acquire very helpful images on site at competitions provided animals and scans are performed out of the sun and wind.



The author scanning sled dogs in Alaska at the Iditarod sled dog race check-in. To avoid environmental artifact, the dogs were brought inside a trailer and allowed to acclimate for 20 minutes before scanning.

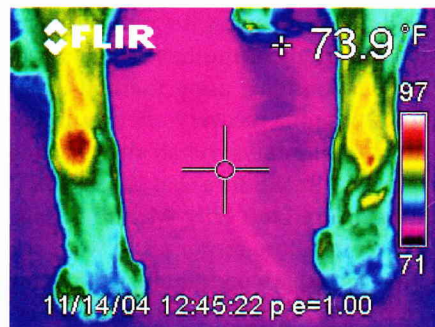
## What Can Thermal Imaging Show?

So what does thermal imaging in the performance dog look like? My practice patients include not only agility dogs, but also dogs that do flyball, obedience, herding, police/patrol, explosives/drug detection, wild-land search-and-rescue, sled dog racing, and avalanche rescue, so we see a wide variety of problems. Before we look at some clinical examples of what thermal imaging can show, here is a little primer on how to interpret the images from this particular camera. On the right of the image is the temperature range scale that I used for that particular scan; I can change the upper and lower limits (depending on external environment) as well as how sensitive I want the range to be (i.e., now many degrees between the upper and lower ranges). Above the upper temperature limit and the image will be white; below the lower limit and the image will be black. I can adjust this during a scan to give me the best possible detail in the color range

that I like to see (everyone is a bit different in their color preferences). The crosshair in the middle is the temperature shown in the upper right. On the camera itself or within the software, I can move both the crosshair to measure specific areas as well as the range.

Following are some examples of how thermal imaging is used in our performance dog practice.

This is an agility dog with a strained Achilles tendon insertion. Notice the red spot (indicating a warmer area) at the attachment of the left Achilles tendon to the hock that is not present on the other

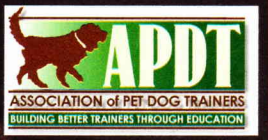


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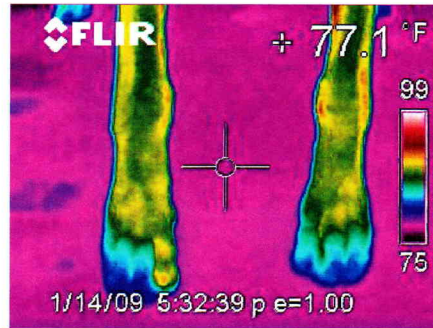


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side. The presenting complaint was that the dog's times would start slowing down by the second or third day of a trial. There was no pain on palpation but the dog would visibly stop jumping or slow down after several minutes of running around. X-rays showed no changes. This dog was managed with rest, acupuncture, and manual therapy. She was not allowed to go back into work until the hot spot was gone and the tendon was monitored after exercise for an additional eight weeks.

This is a cranial view (from the front) of an agility dog's front legs. This dog had a three-month history of knocking bars when he approached from a left turn. Eventually, his issues progressed to him being unable to maintain his weave poles. At presentation for the scan, he had started to manifest a slight, vague

lameness after exercise or training. Non-steroidal medications had inconsistent effects and the referring veterinarian's radiographs of the hind legs showed no obvious boney or joint problems. Thermal scan showed marked heat of the inside toe of the right front leg (the limb on the left side of the image) with some changes in the left wrist (leg image on the right).



A thorough exam of those areas found swelling and marked pain of the toe with some discomfort upon flexion of the left carpus (wrist). Radiographs of the toe did not show any fractures so a severe sprain with possible joint laxity was diagnosed. The dog was treated with ice, cold laser, support wraps, and homeopathic remedies. The dog returned to competition 16 weeks later with no problems (and the owner was better about keeping the nails trimmed).

Heat is not the only abnormality that can show up. Cool areas are also signs of problems. Areas can become cold if there is pain (nerve reflexes will constrict blood vessels in the area) or if there is edema or bruising. In the scan on the following page, you can see a cooler, green area in this agility dog's flank which was puffy



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