

Mapping the flow of the future

Thermal imaging, like ultrasound so many years ago, struggles to gain traction as a diagnostic tool in clinical practice, but many believe in its potential.

By Jackie Brown

A manatee with a bum shoulder and a chance meeting with a researcher gave one veterinarian his introduction to thermal imaging 30 years ago.

Mike Walsh, DVM, clinical associate professor at University of Florida's College of Veterinary Medicine in Gainesville, first used thermal imaging in the 1980s while working at Sea World. He happened to wander by as Tracy A. Turner, DVM, MS, Dipl. ACVS, Dipl. ACVSMR, was working on his early thermal imaging research at the UF's equine clinic. Dr. Walsh wondered if the thermal camera might help him figure out the extent of an infection in a manatee's shoulder. The two veterinarians got together at Sea World and turned the thermal camera on the animal.

"Dr. Turner came down and we were able to see that the extent of the involvement was much more than I could visually see, so that pushed me into doing a surgical

approach that was a bit more radical," said Dr. Walsh, who is also the clinical coordinator of UF's Aquatic Animal Health Program. "Then we went around to the killer whales and the dolphins and realized, well this is a great idea. We could see sites of inflammation, we could see infected teeth that we wouldn't see otherwise."

More than three decades later, the use of thermography as a diagnostic tool is still struggling to gain traction with veterinarians in clinical practice. But Walsh thinks it might eventually find its place in the veterinary field.

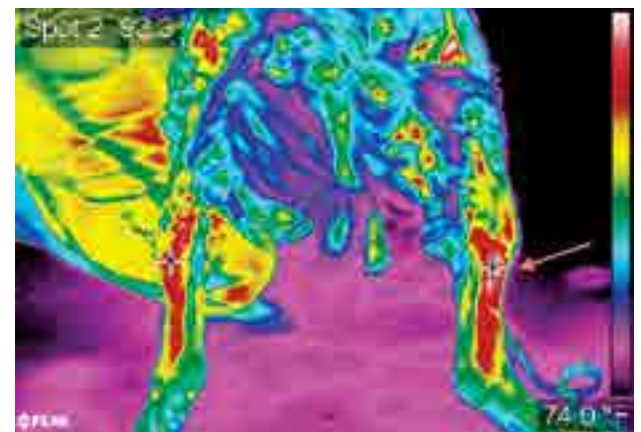
"It's slowly making its way into small animal medicine," he said. "Its potential has barely been tapped because there's just not enough people doing it. Like most of these newer approaches, if you're not taught it in vet school, you tend not to use it. When you look back at the use of ultrasound, back in the early 80s, it was untouched [in the veterinary field]. But then the veterinary schools started teaching students about it. It can take 20 to 30 years to get a modality adopted."

G.J. Rockley, director of operations for Teletherm Infrared Systems based in Tampa, Fla., said that the use of thermography in general veterinary practice is increasing.

"Major animal research institutions around the world have been using infrared technology for years," he said. "With the smaller, less expensive hand-held cameras, there has been a noticeable uptick in users over the last two to three years."

How thermography works

"Thermal imaging looks at physiology and, due to being truly noninvasive, complements other imaging and diagnostic technologies, helping to provide a direction that may not have been considered," Rockley said. "It gives an efficient and immediate assessment of inflammatory-, vascular- and soft tissue-related conditions, helping locate key focal regions to concentrate on. It also can dynamically show progress before and after a particular therapy."



Thermal scan of hind legs in a young sheepdog that started limping on its right hind while competing. This dog had a thick, long haircoat, but the legs still could provide information. There was increased heat in the right hind lateral mid-tibia (red arrow).

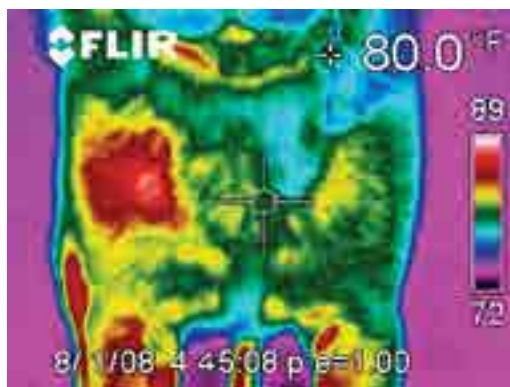


PHOTOS COURTESY KIMBERLY HENNEMAN, DVM

Above: Kimberly Henneman, DVM, Dipl. ACVSMR, FAAVA, Dipl. ABT, CVA, CVC, of Animal Health VIPS in Park City, Utah, scans sled dogs at the Iditarod check-in with an FLIR B-2 camera.

Left: Poorly fitting avalanche harness putting pressure and restriction of movement over shoulder joint.

Below: Harness rub causing shoulder trauma in an avalanche dog.



Thermography dos and don'ts

Kimberly Henneman, DVM, Dipl. ACVSMR, FAAVA, Dipl. ABT, CVA, CVC, of Animal Health VIPS in Park City, Utah, offers these tips for getting started in thermal imaging:

Don't be afraid to turn the camera on and scan an animal, even if you're not sure what you're looking at. The best way to feel comfortable with the technology is to use it—a lot. Thermography has a learning curve similar to ultrasonography. Dr. Henneman said it takes about 50 hours of camera time to feel comfortable with the technology.

Do review your anatomy. If using it for lameness or sports medicine diagnosis, understanding how muscle, tendons, ligaments and fascia work in unison in total body biomechanics makes it easier to understand the thermal patterns that might be seen in performance or working dogs.

Do educate your staff to properly teach clients how to prepare animals for a thermal exam. Dogs should not be bathed, go swimming, sit in front of a heater or air conditioner, sit in a window sunspot or come in wearing harnesses, booties or vests (unless the goal is to evaluate the fit of that item).

Don't try to go it alone. Get the proper training. ●

A thermography camera detects heat at the first 5 millimeters of the skin's surface.

"What you're seeing is a map of blood flow as a manifestation of the heat that it emits from the body," said J.K. Waldsmith, DVM, owner of the Equine Center in San Luis Obispo, Calif. "A normal animal will have the same amount of blood on one side of the body as another. If you see there is a difference between one side of the body and another, those differences should be investigated."

But interpreting thermography images is not simply a matter of looking for "hot" areas. Painful areas might appear hot and they might appear cold, depending on the cause of the pain.

"The significance is based on understanding the nature of the pain," said Dr. Waldsmith, who also is founder and president of Vetel Diagnostics, a veterinary diagnostic imaging company. "Clinically, with chronic painful conditions you actually have decreased blood flow. If you were to look at an arthritic person's hands with a thermal camera they are actually quite cold. To use thermography properly, you must understand what controls blood flow at the skin surface. And that's really where the veterinarian comes in with their understanding of the physiology of blood flow as it relates to temperature regulation of the body, inflammatory processes, and the nervous system's control of the blood flow at the skin's surface."

Performance uses

Kimberly Henneman, DVM, Dipl. ACVSMR, FAAVA, Dipl. ABT, CVA, CVC, of Animal Health VIPS in Park City, Utah, uses the technology with performance horses. She was one of the first veterinarians to employ thermal imaging in canine performance medicine and rehabilitation, working with patients that compete in sheep dog trials, agility and sled racing.

"I'm often the veterinarian on site at major dog competitions," Dr. Henneman said. "I pull the thermal camera out to localize and enhance the physical exam of dogs that have developed lameness or vague performance problems. Additionally, we have a clinical day only for performance clients to have thermal and structural evaluations done of their dogs. This has been a great practice builder with performance clients and handlers."

At a recent major sheep dog trial, Henneman used thermal imaging to guide an ultrasound exam of a dog that had developed muscular lameness after its run.

"A grade-3 muscle tear was quickly identified in the lateral digital extensor, and the appropriate therapy guidance was provided to the handler," she said.

"Thermal imaging looks at physiology and complements other imaging and diagnostic technologies, helping to provide a direction that may not have been considered."

—G.J. Rockley, director of operations for Teletherm Infrared Systems

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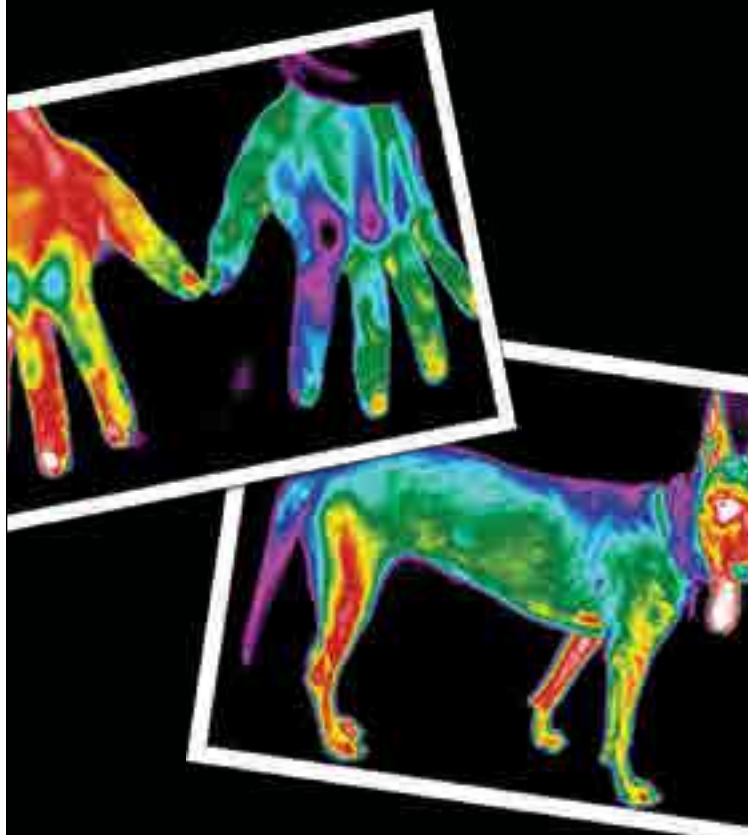
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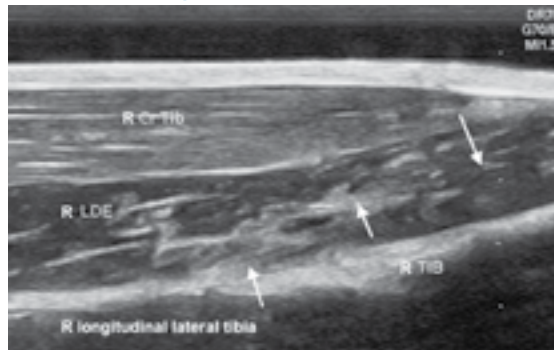
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SmallAnimal

Thermal, from page 45



Ultrasound of right hind musculature in area of increased heat pattern seen in the thermal image. Significant disruption of the muscle fiber pattern of the lateral digital extensor muscle is visible.

Henneman uses thermal imaging for sled dogs, including marathon Iditarod dogs.

“One year I took the thermal camera to the pre-race check-in,” she said. “We had numerous unexpected findings, such as the presence of harness dermal inflammation still present hours after the dogs had run in them. Since then, I have used the thermal camera during training periods to help both marathon and sprint mushers identify areas of asymmetrical stress in training dogs before they become lame, as well as to find the right type of harness to fit a particular dog.”

Getting started

As with any diagnostic tool, veterinarians interested in getting started in thermal imaging must be trained both in the use of the equipment and interpretation of the images.

“First familiarize yourself with the published veterinary protocols and diagnostic medical camera requirements that are published with the American

Academy of Thermology,” Henneman said. “These are the only protocols written by a consortium of veterinarians experienced in the research and clinical use of thermography. Then they make sure that you are getting your equipment from reputable companies who provide cameras that meet clinical resolution and palette requirements, as well as appropriate veterinary-specific training.”

Then there’s the cost of the equipment to consider, which ranges anywhere from \$5,000 to \$30,000 on average.

“This was a very expensive piece of medical equipment when I bought my first unit in 1987... \$100,000-plus,” said Ron Riegel, DVM, medical director of thermal imaging company Digatherm, based in Ocala, Fla. “Price is now affordable for every practice. Technological advances have allowed an improved sensitivity, accuracy and resolution, and veterinary specific software for analysis was just recently introduced.”

According to Dr. Riegel, 80 percent of the patients seen daily in a companion animal practice would benefit from an infrared physiological exam.

“A small fee of \$20 to \$50 per exam allows a return of investment to pay for the equipment within six months,” he said. “We are a visual society. In providing visual evidence to the client, they will be more compliant to further diagnostic procedures.”

Walsh urges interested practitioners to step outside their comfort zone and give thermal imaging a try. “There’s a comfortability factor you’ve got to adapt to and a fear factor you have to get over,” Walsh said. “You need to have an adventuresome spirit and a desire to try new things. It’s not meant to be your be-all-end-all diagnostic approach, but it’s a great addition to diagnostic capability, depending on what area of medicine you’re interested in.” ●

Key veterinary uses of thermography

Thermal imaging has been used with aquatic animals for several decades to assess injuries and dental issues. “It’s also used in zoos because they don’t want to handle the animals if they don’t have to,” said J.K. Waldsmith, DVM, owner of the Equine Center in San Louis Obispo, Calif., and founder and president of Vetel Diagnostics, a veterinary diagnostic imaging company.

Thermography is also helpful for the follow animal categories:

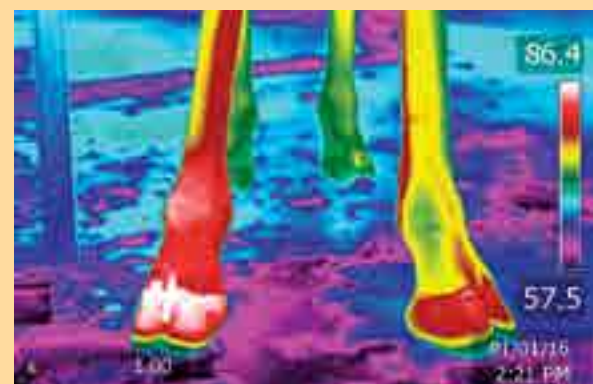
Equine: Currently, the majority thermography’s clinical use is with horses to monitor and find areas of soft-tissue musculoskeletal disease. It’s also used in hoof care and to assess proper saddle fit.

Food animal: Similar to its use with zoo animals, thermography is a way to noninvasively determine if a herd animal has an elevated temperature. Also used to detect mastitis in dairy cattle.

Small animal: As with horses, thermography can help assess osteoarthritis and musculoskeletal abnormalities, such as shoulder injuries in sled dogs and tendon injuries in agility dogs. It also has the potential to help to detect hypothyroidism in dogs, and hyperthyroidism and osteoarthritis in cats, as well as to monitor therapeutic progress and wound healing. ●



Thermal image of the hindquarters of an African elephant that has had a chronic right hind lameness. Not only is there increased heat of the left sacrum as a part of compensation, but there also is a (repetitive) thermal pattern asymmetry of the ears.

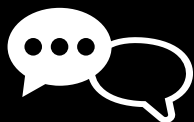


Giraffe feet demonstrating inflammation of the right front foot.

SEE PAIN

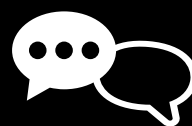
FIND THE SPOT. TREAT THE SOURCE.

Where does
it hurt?



I don't know
where it hurts

When did it
start hurting?



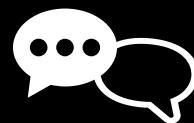
It started hurting
yesterday
... I think

I recommend early
intervention.



My pet is fine and
I will wait to treat

How does your
pet feel now?



I am not sure if those
treatments worked



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