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# Accent On Applications

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## IR Imaging Exposes Equine Ailments

Save for the famous Mr. Ed, horses can't tell a veterinarian what's wrong with them. In fact, a horse not only is unable to communicate its symptoms, but also makes a concerted effort to hide them. Such suppression makes it particularly difficult for veterinarians to diagnose disease in their equine patients.

Dr. Jim Waldsmith, a veterinarian

with The Equine Center in San Luis Obispo, Calif., said that "Animals like horses ... have all evolved from the wild and are designed to not show their problems or pain — it's an evolutionary survival tactic."

Therefore, veterinarians have to rely mostly on imaging techniques to diagnose a problem. According to Waldsmith, imaging methods fall into two general categories: anatomical

and physiological. Anatomical imaging, such as the kind performed with x-rays, can easily expose a structural problem in a horse. The hard part is homing in on the injury in the first place. For this, veterinarians rely on physiological imaging tools. Nuclear imaging techniques such as PET and SPECT are pretty good choices but require that the horse be transported to a lab full of bulky equipment.

Another physiological imaging tool, IR thermal imaging, has carried favor with veterinarians in recent years. It provides information comparable to, if not slightly less detailed than, nuclear imaging methods. However, it has the advantage of being relatively portable, fast and noninvasive because it doesn't require injection of radiopharmaceuticals.

### Hot and cold spots

Thermal imaging measures the heat generated by blood flow — or the lack thereof — in specific areas of the body. "Blood is the hottest

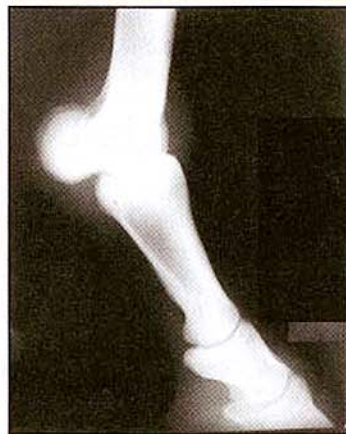
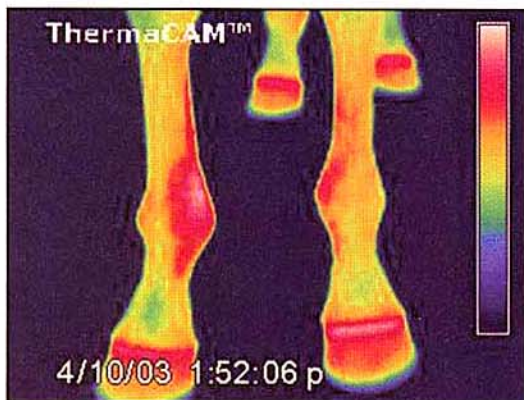
thing in the body," Waldsmith said. And when an injury occurs — in humans or in horses — inflammation accompanies it. The resulting increases in blood flow, known as "hot spots," often can reveal an injury days before symptoms present

themselves. Similarly, cold spots or areas of low blood flow can unmask vasoconstriction that occurs as a result of nervous system malfunction. Typically, infrared cameras display the relative IR emissions on a liquid crystal display (LCD) in the colors of the visible spectrum, with red designating hot and blue indicating cold.

Thermal imaging cameras have always been smaller than their nuclear-based counterparts, but they still are rather unwieldy, with most weighing in at around 6 pounds and requiring two hands to operate. But



*IR thermal imaging provides veterinarians with a fast and easy method based on blood flow for locating injuries in horses before conducting further structural imaging. Here, thermography shows heat in the right front ankle, and a corresponding x-ray image reveals a fracture. Likewise, thermal images of a different horse show significant heat in the right front ankle, subsequently diagnosed as a bone chip in the x-ray image.*



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thermal cameras continue to shrink while retaining or improving resolution and imaging speed, providing a big advantage to veterinarians working in the field.

"When you are working on horses, especially racehorses, they are very prone to quick movements, and it is a big advantage to have one hand free ... in case you have to move fast," Waldsmith said. "Also, there are times when you want one hand free, for example, to use the camera to guide you as you make an injection into the hottest point of an abscess."

He uses a variety of ThermaCAM E series cameras from Flir Systems Inc. of North Billerica, Mass., which weigh in at about 1.5 pounds including batteries and which can be held in one hand. Despite their small size, they retain the resolution of previous models. And although the cameras can store up to 100 jpeg images, which can be viewed on their LCD, they can also connect to a PC, video recorder or both for real-time display and permanent storage.

Waldsmith said another advantage is the camera's imaging speed of 60 frames per second, which enables imaging of moving targets — important because some injuries don't reveal themselves when the horse is stationary. At lower frame rates, the image can be blurred when played back, he said, adding, "The 60-Hz frame rate allows slow-motion playback of the image without distortion or blurring, allowing very accurate analysis at high speeds of issues such as friction on the foot or air passage through the nostrils."

The company dubbed another built-in feature the Laser LocatIR. Something akin to a laser pointer, this technology allows users to quickly orient the IR image via a red

laser diode that emits a beam roughly coaxial with the center of the IR camera's field of view. This feature also comes in handy when imaging fidgety horses or when working in a dark environment.

A disadvantage of IR thermal imaging continues to be that it measures only the surface temperature of the skin. In horses, this can still be adequate for diagnostic purposes, as the types of injuries that trainers and owners are most concerned about are in the legs, which are relatively lithe. But it is important that the horse be dry — surfaces that recently have been washed or had liniment applied to them can show great variations in temperature.

### Prices dropping

The price of thermal cameras is comparable to that of other imaging tools — those in the ThermaCAM E series range from about \$14,000 to approximately \$18,000 without accompanying software. Waldsmith said the price of all IR cameras has been coming down recently because of the technology's security applications. Thermal imaging cameras, for instance, have been explored as a way to reveal concealed weapons, to detect when a person is lying based on blood-flow changes in the face, and to identify individuals with high fevers who might be carrying an exotic infectious microbe such as the SARS virus. □

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