Thermography

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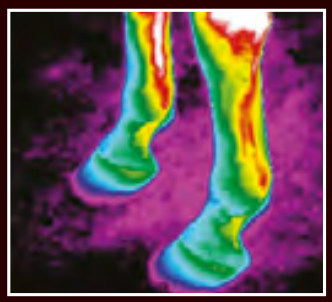
THERMOGRAPHY

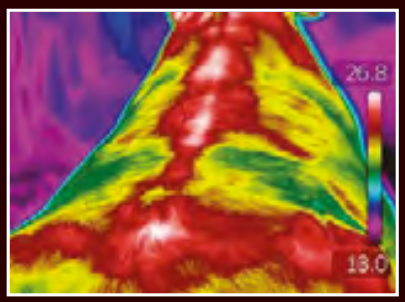
Science and technology are often applied to the world of horses with extreme caution – if you see the glass as half full – or extremely slowly – if you see it half empty - and so some well-known techniques take sometimes decades to be recognized and applied on a large scale. On the one hand, this is certainly due to the cost of equipment, which naturally tends to decrease and so the same technology becomes more and more accessible to a wider audience. On the other hand, there is a certain lack of dynamism in the system, which does not react to the new proposals as quickly as it should.
The use of thermography in horse medicine is a good example of this.

WHAT IS THERMOGRAPHY?

Thermography is the use of an infrared imaging and measurement camera to see and measure thermal energy emitted from an object. Thermal energy, emitted as infrared rays, is light that is not visible because its wavelength is too long to be detected by the human eye; it is the part of the electromagnetic spectrum that we perceive not as light but as heat. Everything with a temperature above absolute zero (i.e. above 273 degree C) emits heat in the form of infrared rays. Even very cold objects, like ice cubes, emit infrared rays. The higher the object's temperature, the greater the IR radiation emitted. Infrared rays can be seen and the quantity of radiations measured through scales of gray or by showing different temperature areas in different colors, allowing us to see what our eyes cannot, i.e. the heat emitted by an object.

Infrared thermographic cameras produce images of invisible infrared or heat radiation and provide an important non-contact tool to measure temperatures. Nearly everything, including inanimate objects, emits infrared light and gets hot before it fails, making infrared cameras extremely cost-effective, valuable diagnostic tools in many diverse fields of application, such as biology, volcanology, ecology, engineering, mechanics and others.
As infrared imaging develops and improves and thermographic cameras become more and more sensitive, new applications are continually created and developed. The applications that we are particularly interested in are those connected with biology and, especially, veterinary medicine, which benefit from thermographic cameras that can detect surface temperature changes by a tenth or even one hundredth of a grade Centigrade. Digital infrared thermal imaging (DITI) and the subsequent analysis has led to considerable progress in assessing and comparing data as well as exact and time-deferred measurement of temperatures.





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IMAGING DIAGNOSTICS

Thermography deserves to be given a place in medicine among diagnostic techniques (those required to understand the reasons of a disease, rather than curing it) and particularly among imaging diagnostics, which benefits also from other more or less recent tools: x-rays, scans, tomography and others.

From this point of view, an important aspect of thermography is its execution time. Whereas diagnosis with traditional x-rays is rather long, due to the time required to develop the radiographs (but digital equipments are also available today, very innovative compared to the traditional methods), thermography imaging can be obtained immediately, saved in digital format and processed straight away through a laptop computer. In addition, the cost of a single image is very low, once the initial, high cost of the thermographic camera and its application software has been amortized. However, as it is often the case with modern technology, the newer models are generally better and less expensive than their predecessors, which is what usually happens with digital cameras or computers.

Essentially, once the thermographic camera has been purchased, a veterinarian is encouraged to use it under many circumstances, with the two-pronged result of providing useful and accurate information to the client and investigating new and interesting fields of application.

THERMOGRAPHY AND VETERINARY

Measuring the surface temperature of living organism is not a new science. Ancient Greeks were already observing the drying-up process of mud spread thinly on the human body, and the fact that the mud dried up more quickly on certain body areas led them to conclude that some parts of the human bodies were warmer than others. Veterinary application of thermography can be seen as the natural heir of these ancient observations.

Thermography is just a technologically advanced evolution of the Greek mud technique; it shows which areas of the body are warmer and which are colder, enabling us to compare various parts on both sides of the body.

The superficial temperature of a body part changes according to many variables: ambient temperature, higher or lower flow of blood in capillaries underneath the skin, presence of local alterations etc.

Local temperature variations are at the basis of veterinary applications. When a tissue or an organ does not work properly, the body produces a reaction called inflammation.

The typical sign of inflammation is the heat produced on that area, which spreads to nearby tissues. This way, the skin covering an inflamed area (an organ, a joint, a muscle) appears of a different color compared to the neighboring areas or to the so-called counterlateral part, i.e. the corresponding part on the other side of the (healthy) body.

When the inflammation is superficial and violent, the temperature differences can be felt also on the palm of our hand. But when these differences are less than 2°C, it becomes difficult to detect them directly, so thermography becomes indispensible. In addition, the horse's coat somehow mitigates and masks the differences, given the well-known insulating properties of hairs.

Thermography can highlight the inflamed areas and so localize the problems that would otherwise be difficult to spot. The sensitivity of the device is obviously of utmost importance in order to obtain concrete results, but the models that are available on the market today are capable of identifying temperature differences of just 0.01°C.

Thanks to thermography, the inflammation to a tendon

can be diagnosed up to 2 weeks before this can be done through other techniques. A similar advantage is often fundamental in proposing the most appropriate treatments and in avoiding that further damage is caused by getting the horses to work in far from perfect conditions.
Once the inflamed area is identified, this can be appropriately treated so that a normal condition than be gradually restored. Thermography helps also in this sense, as it assesses the effectiveness of the treatment adopted to control the inflammation. This aspect is less obvious and secondary than one might think. As every owner knows, being able to assess the progress of an injury is often arduous, and the tools are not always objective. The gradual reduction of the inflammation, on the other hand, can be easily seen through a thermpographic camera, to the joy of the veterinarian and of the owner. In this sense, the thermographic camera is a previous tool also, if not above all, for the veterinarian, who can quickly ascertain the appropriateness of the treatment and, if necessary, recommend timely changes in the cure.

THERMOGRAPHY AND EQUINE MEDICINE

Having the chance to see inflammation at an early stage is of significant interest in equine medicine, for example to check the health status of limbs in case of lameness that is difficult to define. Detecting a change in superficial temperature can often be used as a "guide" to then proceed with an accurate control aimed at the area where the temperature change has been detected. The typical case is that of a joint found excessively warm through thermography. This is subsequently checked through very specific and accurate x-ray tests, which highlight an injury overlooked at the first check. In the same way, it is possible to highlight muscular problems that are difficult to detect through other techniques.
Thermography can also be useful to diagnose abscesses inside the hoof, to confirm the rare cases of shoulder lameness or to highlight signs of inflammation more in general.
The main applications of thermography to the equine field are connected with lameness and muscle, tendon or joint inflammations. However, the field of application has not got such clear demarcation. With a thermographic camera we can notice the increase in temperature of a horse after a standard workout, determining the level of fitness, a term that every sports person knows well. We can also study its effectiveness in dispersing heat. This application, which seems to come out of a sci-fi movie, is already used on men and on race dogs, in combination with appropriate blood analyses. The results obtained are excellent. Once the saddle has been removed, we can also detect which areas were more loaded, hence more prone to risks in the future. Thanks to this, we can also determine the best saddle that "sits" more comfortably on each individual horse.
By analyzing the thermographic images we can also ascertain local decreases in temperature due, for example, to a lower blood flow, as in the case of thrombosis. Finally, we can also measure the heat emitted into the surrounding environment, assessing, albeit indirectly, the energy use of an individual or a group of horses. ❑