SKIN SURFACE TEMPERATURE MEASUREMENTS IN HORSES BY INFRARED MONITORS

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ABSTRACT

The local skin temperature is an important clinical parameter in lameness examination in horses. New cost effective devices to measure local temperature are now widely available these days. Several important areas of the equine legs can quickly and easily be screened and clinically important differences in local temperature can be measured without disturbing the horses.

SAMENVATTING

De lokale huidtemperatuur is een belangrijke klinische parameter in het onderzoek van het manken bij het paard. Op dit ogenblik zijn er verschillende interessante toestellen op de markt die voor een redelijk voordelige prijs betrouwbare lokale temperatuurmeting mogelijk maken. Verschillende gebieden van de ledematen kunnen gescreend worden zonder de paarden hierbij tijdens de meting te storen.

Key words: Horse -Skin - Temperature

This short paper intends to further encourage the daily application of non-contact skin surface temperature measurement in equine lameness by means of infra-red thermometry. We refer to previous publications about skin temperature measurements in horses (Verschooten & Desmet, 1995; Verschooten *et al.*, 1997).

Increased local temperature and swelling are two of the simplest and most important clinical parameters in lameness examination. Of the methods available to measure temperature, electronic contact thermometry is the cheapest and simplest way, but horses do not appreciate direct contact of the probe which might take 1 to 3 minutes to show up a stable temperature reading. An alternative is the Heath camera, a more sophisticated device for total body infrared screening, but this is generally considered to be too expensive for routine examinations in daily practice.

There are now however several new devices available which make skin temperature measurements extremely easy in routine clinical circumstances: Equiscan*, MX2, MX4, MX4+**. One of these new devices (MX2), which was originally designed to measure temperatures of different materials (asphalt, brick, concrete, glass, plastic, wood etc.) has been tested and used on horses in our department for the last 2.5 years.

The device is constructed and handled like a gun (Fig.1) with the area to be measured outlined by a 16 laser pointed circle. On squeezing the guns trigger, the temperature is instantly measured on a small monitor (Fig. 2). This can be at any distance with the laser target confirming the area measured. The laser points are easily observed indoors and may be seen outside as well in a shaded area, but are impossible to see in bright or direct sunshine unless you are close to the animal.

The amount of infrared energy radiated by an object depends on its emmissitivity and its temperature. Different materials have different emmissitivity values; for example brick: 0.90; glass: 0.85; cloth: 0.95. A value of 0.96 was set for fur or hair regardless of colour. This data was obtained by comparing the readings on an MX2 with implanted telemetry sensors in mice (personal communication. M. Brampton, Thames Medical).

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* Equiscan, Ortomedic, Le Goutey, 4, 13122 Ventabren, France

** MX2,4, 4+, (Raytek®), Thames Medical, 2 Winston Business Centre, Chartwell Road, Lancing, W.Sussex. UK., BN15 8TU, England, www.thamesmedical.co.uk/vetirframeset.html

Fig. 1. The MX2 is demonstrated outside in bright light, but when used outside in fact a shaded area is necessary. The examiner can stand on any distance from the horse and easily read the temperature on the screen of the monitoring device from any possible area.

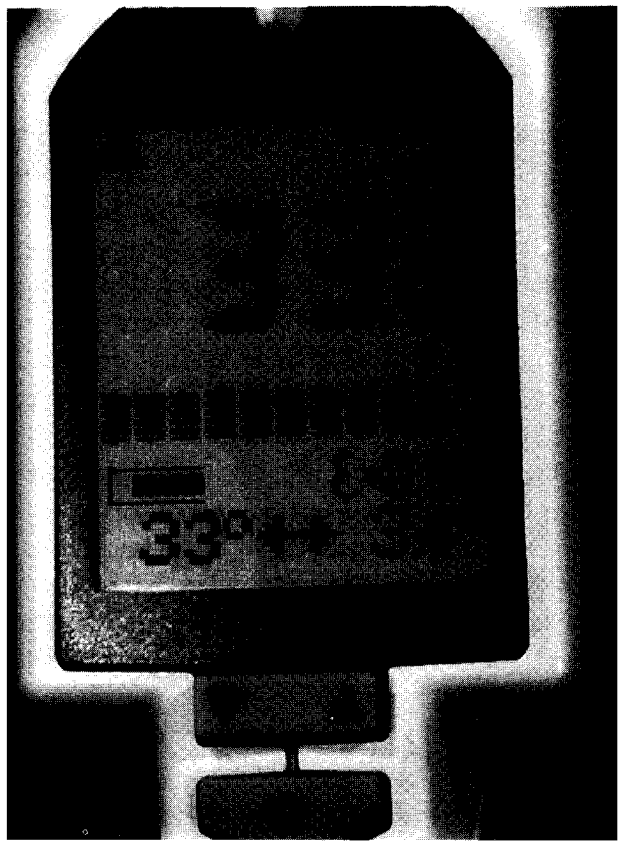

Fig. 2. On the monitor the temperature is outlined. The temperature is fixed on 33°3 and the range of temperature changes is outlined o the bottom of the monitor: 33° - 34°. The local temperature is almost fixed. The emmissivity is indicated by epsilon = 0.98 The small bars indicate continuous temperature measurements.

The temperature measurement range for the MX2 is from -30 to 900°C and the accuracy is 1%. The response time is 250 msec. In one device (MX4+) the last 100 readings can be recalled and Windows based data management software used to graph the temperature data and analyse trends.The temperature of the spotted or targeted area is continuously measured: 10 measurements for each value are continuously outlined on the small monitor (a bar graph charts last 10 temperature points). If a brick wall is measured, the temperature of the surface is immediately outlined with a fixed number on the monitor. If the skin at whatever area of a living animal is screened, the temperature varies almost continuously and rarely do we get a fixed and stable number. Temperatures will fluctuate continuously e.g. from 26°3 to 27°8 C. When two areas are to be compared, the fluctuations and mean values are both compared. If the temperatures of two comparative measurements are more or less fixed numbers, than the comparison is of course much easier. Differences in temperature of 2° are clinically relevant.

A frontleg or a hindleg can be quickly screened within one to two minutes. Reference points for the frontleg are: the dorsal part of the hoof wall, the dorsal coronet, the dorsal part of the metacarpophalangeal joint, the dorsal part of the carpal joint, the lateral part of the elbow and shoulder joint. In the hindleg following reference points are mostly used: distal part of the limb like the frontleg, the lateral, medial (=spavin area) and dorsal part of the tarsal joint, the lateral and dorsal part of the stifle joint. Whenever other areas are suspected by clinical examination additional measurements are made: the sole in pododermatitis, the splint bone in splints, the palmar or plantar areas of the metacarpal/metatarsal areas in tendinitis, the caudal or rostral maxillary sinus in sinusitis. If pododermatitis is present differences in local temperatures between the affected and sound foot may be 5 to 8°. In unilateral lameness increased temperature is often found on the sound foot. This is frequently observed and can be misleading because pulsation of the digital artery may be present as well; digital pulsation and increased temperature are then the clinical signs of collateral overload.

From using electronic skin temperature measurements, we have found that even differences of 1,5 ° to 2° C can easily be distinguished by human senses (e.g. a difference between 26° and 27°5 C). One should feel with the dorsal aspect of the fingers and be very concentrated. Amazingly, too much noise e.g. may affect our accuracy to evaluate the local temperature. Contact time of the finger with the skin should be equal if

two skin areas are compared. However if the skin temperature is above 30° it is more difficult to feel these 1.5° - 2° differences! Using a device like the one presently described it is a lot easier to control and confirm manual temperature evaluations. The measurements should be made before horses are trotted during the examination. Most reliable data might be obtained in the stable after the horse has been rested for one night. Many factors may of course hinder and/or enhance thermographic evaluation: uneven hair coat, scars from old injuries, exercise, sweating, body coverings, topical medication (Purohit and Pascoe, 1994).

In cases where no definite diagnosis can be made using other techniques, thermography has been efficacious for early diagnosis of soft tissue and joint injuries (Purohit, 1994). In our opinion the advantages and cost effectiveness of thermography are generally overrated and the value of the data exaggerated particularly in claims of successful early diagnosis of injuries in the cervical, thoracic, and lumbosacral areas which are difficult to diagnose even with X-rays and ultrasonography. Likewise claims of early and easy differentiation of clinical and subclinical cases of osteo-arthritis, tendinitis, navicular disease, subsolar abscesses and laminitis are exaggerations. A skin temperature increase is a very important clinical finding but not specific enough for an early exact diagnosis. Surface skin temperature measurement objectifies a clinical impression of increased or decreased heath, not more not less. It is not the exact temperature that is important, but differences between comparable body parts. Using an infrared gun like the MX2 the measurements are quick, easy and do not disturb the horses. The accuracy of infrared thermometry monitoring is about ± 1%. Moreover, the devices are not too expensive (35.000 BF - 56.000 BF). Compared to thermal imaging they are really cheap tools. A number is not as spectacular as a thermal image, but the information obtained is diagnostically valuable.

ACKNOWLEDGEMENT

The authors would like to acknowledge the assistance and support of Mr Mike Brampton from Thames Medical in the preparation of this paper.

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