Short Communication on Veterinary Medicine

The Healing Effect of Water-filtered Infrared-A-Radiation hydrosun<sup>®</sup> Irradiator

with the patented filtersystem







# The Healing Effect of Water-filtered Infrared-A-Radiation

## Use of special heat radiation to tackle the root of the problem

#### Summary

Water-filtered Infrared-A-radiation (WIRA) is the deep penetrating, but harmless component of the sun's infrared radiation. The unique principle of operation involves the use of a hermetically sealed water filter in the radiation path to absorb those infrared wavelengths emitted by a common infrared source which would otherwise result in intense overheating of the skin surface and rapid tissue dehydration. Hence, with the higher radiation intensity, therapeutic heating of deeper tissue layers over longer periods of time can be achieved.

In human medicine, WIRA is already successfully being used for wound healing and e.g. arthropathy. It is also being used more and more frequently in veterinary medicine, e.g. to treat deep-located processes. This article explains the method and presents an impressive case study.

After the gelding Kent suffered an injury on the neck during transport resulting in nuchal bursitis (poll evil) which developed shortly afterwards into a purulent fistula, an operation seemed inevitable. As a last attempt in conservative therapy, the horse is treated with water-filtered infrared-A-radiation (WIRA) which leads to the desired healing up. Today, Kent is again pain-free and strong enough to be used for rides.

# In Brief- The History of Infrared Radiation

At the beginning of the 19th century, the German-British astronomer Sir William Herschel (1738-1822) discovered infrared radiation as part of the solar spectrum. He used a prism to refract light from the sun and, at the same time, he held a thermometer into the spectrum. He observed that the highest temperature could be measured beyond the red region of the visible spectrum, in an area displaying no colour. Infrared radiation is one of the most natural heat sources. It is also described as heat-radiation emission. since it stimulates the natural molecular motion and can be felt as heat by receptors in the skin.

Infrared radiation is invisible and is divided into:

- Infrared-A (IRA) with wavelengths from 760 nm to 1400 nm
- Infrared-B (IRB) with wavelengths from 1400 nm to 3000 nm
- Infrared-C (IRC) with wavelengths from 3000 nm to 1 mm

However, without the protective filter of the humid atmosphere, the sun's infrared radiation can lead to extreme dehydration: this can be seen in the earth's desert regions where extremely hostile conditions prevail. Only through the filtering effect of the water in the atmosphere does the sun's radiation lose its harmful impact.

The hydrosun<sup>®</sup> irradiator reproduces the combination of the sun and the humid atmosphere. Without producing ultraviolet rays, its emission lies in the deep penetrating area of IRA. However, the well tolerated IRA-spectrum also includes water-absorption bands at 944 nm, 1180 nm, and 1380 nm. The water-filte-red infrared-A-radiation (wIRA) allows a heating of tissue with a high penetration depth and without overheating of the skin surface.

In contrast IRB and IRC allow only superfical effects: Absorption of the energy of IRB and IRC through the water molecules in the most superficial skin layers results easily in a stinging and burning sensation due to intense overheating and rapid tissue dehydration. As heat source IRC can only act either through direct skin contact or indirectly by warming the air. IRB can only heat the skin surface.

### Infrared in Medicine

Infrared radiation for therapeutic use needs to be skin friendly and able to penetrate into deeper layers. There are two options to provide suitable infrared irradiation, while, at the same time, eliminating intolerable components:

1. By finding infrared sources with a radiation spectrum which does not contain any skin stressing components. This is the case for most infrared laser devices which work with just one wavelength. Their disadvantages are their very limited irradiation area and high purchasing costs.

2. By filtering out those spectra components from the radiation of the infrared source (e.g. halogen lamps) which are harmful to the skin and are only effective in superficial skin layers. The advantage of this method is that it makes intensive irradiation of large skin areas possible.

## The hydrosun® Irradiator

The development of the hydrosun<sup>®</sup>-Irradiator (Hydrosun Medizintechnik GmbH) was based on the second option mentioned above:

A special hydrocuvette is used to filter radiation emitted by a halogen lamp thus removing radiation components which are harmful to the skin. As a result of this process water-filtered infrared (WIRA), therapeutic radiation in the infrared range, is achieved which is characterised by its tolerability (no burns) and particular deep penetration capacity. It can also be described as medical infrared. The hydrosun<sup>®</sup>-Irradiator emulates so the interplay of the sun and humid atmosphere. With wavelengths between 760 nm and 1400 nm, Fig.1) the emission radiation of the irradiator lies within the physiologically significant thermal infrared A region and is free of UV radiation (Fig.1). The hydrosun® irradiator reproduces the interplay of the sun and the humid atmosphere. Its emission lies in the physiologically relevant and deep penetrating area of IRA with wavelengths from 760 nm to 1,400 nm. The hydrosun® irradiator ist a mobile and easy to operate device which only needs to be plugged into a power socket. Since with the application of heat therapy in the area of physical medicine an improved blood circulation in deeper tissue layers is desirable to increase metabolism and to wash out metabolites, the hydrosun® irradiator clearly supersedes conventional infrared lamps.

# The hydrosun<sup>®</sup> spectrum within the electromagnetic radiation



#### Fig. 1 The hydrosun®-radiation frequencies in the electromagnetic spectrum

#### Working mechanisms of WIRA

WIRA acts both by thermal effects as well as by non-thermal effects [1]. As an effect related to the transfer of heat radiation energy to tissue WIRA produces a therapeutically usable field of heat in tissue by:

- reaching capillaries of the skin byinfrared-A-radiation (primary warming)
- heat distribution by the blood stream
- increasing capillary blood flow with expansion of the blood-flow areas accessible to the radiation and by this augmenting the second mechanism
- conduction of heat into the depth
- secondary energy release by stimulation of metabolism caused by the increase of temperature
- high primary depth effectiveness of WIRA.

Non-thermal effects of WIRA (without a relevant change of temperature) are based on putting a stimulus on cells and cellular structures as a specific (direct) radiation effect [1]. E.g.:

- target oriented growth of surface extensions (plasmodia)
- influence on the cytochrome c oxidase
- target oriented growth of neurons
- stimulation of wound repair
- cell protective effects (including signalling pathway)

For WIRA with appropriate therapeutic irradiances it could not only be demonstrated, that it is harmless, but that it has cell protective effects against UV-damage. In addition, wavelengths within wIRA have been shown to influence adhesive interactions between cells and extracellular matrices, playing a regulative role in wound repair processes, and may have a positive effect on cosmetic results.

In human medicine, improvement of wound healing by WIRA has been demonstrated in numerous clinical trials and case studies [3; 4]. Fresh operation wounds [2], as well as chronic wounds [4], experimental wounds and severe burnings could be successfully treated [3]. Research showed that WIRA considerably increases the oxygen partial pressure and the blood flow in tissue - two factors which are crucial for an improvement of wound healing as well as for infection defence. Remarkable pain relief and wound cleansing properties could be observed together with the tendency of less complications on wound healing.

#### WIRA in Veterinary Medicine

In veterinary medicine, WIRA has so far found application as deep-penetrating heat application, for instance within physio- and osteotherapeutic treatments for pain relief and prevention, muscle relaxation, joint problems and wound healing. Due to the deep-penetrating heat application – without the commonly occurring overheating of the surface – the patient does not feel any burning or stinging sensation. The acceptance by horses, dogs, cats and birds is very high.

#### Indications

Indications of WIRA in veterinary medicine include:

- Arthrosis
- Chronic recurrent pain syndrome (e.g. lumbago)
- Traumata (strains, wounds)
- Muscle hardening
- Bronchitis

But let's turn our attention again to the gelding suffering from nuchal bursitis. In the following, his case is presented in detail.

#### Case Study Anamnesis

Kent, a 16 year old riding horse, harmed itself during a transport in a horse trailer when he bumped his neck. As a result, a pronounced swelling of the bursa was observed which was treated with perfusion-stimulating creams by the veterinary. Nevertheless, the bursa broke open 3 months later. The gelding was subsequently treated with antibiotics and the wound was covered with lipocolloid wound dressing. Due to the fact that no improvement occurred, the neck of the horse was x-rayed 6 weeks later and a fistula diagnosed. Canal and fistula should have been rinsed regularly with a streptokinase containing gel. However, this treatment could only be applied 3 times, since the horse didn't tolerate the painful treatment any longer. Several veterinaries recommended surgery now. Thereby the nuchal ligament (funiculus nuchae) from the squama occipitalis to the posterior border of the axis-vertebaral body was to be removed (partial resection of the nuchal ligament) and the fistula was to be excised spaciously. 6-8 months were estimated as convalescence and the chances for a success were considered very low. In addition, the age of the horse signified an increased risk for surgery.

#### **Clinical findings**

Seven months after the accident, a more than fist-sized, painful swelling above the second cervical vertebra can be observed, which decreases towards the first and third cervical vertebra. The swelling affects mainly the left side whereas the right side is only affected near the exit of the fistula. Extension and flexion of the neck are guite restricted. The muscles between the head/masseter and the fourth cervical vertebra (C4) are swollen and hardened. The horse keeps its head mostly below the point of shoulder and its movements all over the body are insecure. In addition, it shows a total lack of interest in its surroundings and its conspecifics. Pus is permanently flowing off from the fistula exit (Fig. 2a).

#### Treatment

WIRA was chosen for the trial of treatment, since in human medicine the application of water-filtered infrared-A-radiation as a gentle, contact-free and painkilling therapy modality was demonstrated to be highly effective. Furthermore there are little other therapy options left. Irradiation is applied vertically from above, pointing directly at the fistula with a distance of 25-30 cm (routine distance in therapeutic use).

The first 4 days the treatment time is 15 min. From the beginning the irradiation is well-tolerated. The horse relaxes visibly under the hydrosun®-Irradiator. Due to the high tolerance and the positive reaction of the horse, from day 5 onwards irradiation is applied twice daily, Subsequently the treatment time is gradually increased to 30 minutes tiwce daily. Hepar sulfuris D4 and Silicea is given to the horse as well as two acupuncture treatments in order to boost

#### Healing process

the general state of health.

After 2 weeks (Fig. 2b) a significant size reduction of the fistula can already be observed. The swelling is now limited to the left side. Hardly any pus flows off from the wound, increasingly mixed with blood (the discharge over a



Fig.2a to c. Swelling of the nuchal bursa and fistula: Purulent discharge is permanently seeping from the wound at the time of assessment (a). Significant improvement can be observed two weeks after WIRA®- treatment (b); after three weeks the swelling had clearly abated. (c).

period of 8 hours equates to that discharge per hour two weeks before). The general condition has improved considerably and the sensitivity to pain has been strongly reduced. The treatment continues to be well tolerated. Extension and flexion of the neck are clearly improving. but have not yet been fully regained. Irradiation treatment is being continued with two daily sessions, 30 minutes each. After the third week of treatment, the swelling has decreased significantly (Fig. 2c). Sensitivity to pain around neck and fistula is no longer to be observed. Hardly any purulent discharge is seeping from the wound (no more than a couple of drops per day). The muscles between the head/masseter and the cervical vertebra C4 however are still slightly swollen, but now without any hardening. The gait is normalised and the general condition considered to be very good. Now the horse is once again lively, bucking and galloping across the paddock. The cervical spine has regained full mobility. Even extension and flexion no longer pose any problem.

#### **Final Evaluation**

After 2 further months of irradiation no further improvement can be observed. The radiographs are therefore examined by another verterinary. A bone fragment in the nuchal ligament near the first vertebra (CI) is clearly visible. There is reason to suspect that the fistula was caused by the permanent irritation of the ligament through the bone fragment rather than an infected bursa. Since the surgical removal of the bone fragment is out of the question, it has to be assumed that the fistula will never fully heal. After the ending of the treatment a slight increase in the amount of purulent discharge can be observed. Nevertheless. increased swelling does not occur. The achieved treatment success such as full mobility, pain-free state, resilience and supple muscles remain stable and do not regress. 6 months after treatment the horse is once again used for riding. The fistula appears to have collapsed and at present seems to be inactive. The horse is said to be in top condition. This case shows impressively that the positive effects of WIRA on wound healing represent a prospect which is transferable from humane medicine to veterinary medicine.

#### Literature

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