Laser Therapie in Veteniary Medicine

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Summary

The effect of Low Level Lasertherapy (LLLT) is documented by a lot of scientific investigations. Nevertheless this therapy is not appreciated enough by orthodox medicine. In this paper the results of the most important investigations of LLLT are summarized and the findings of a long-standing own experience is reported. The possibility of usefull combination with laseracupuncture is shown.

Key-words: Lasertherapy, Veterinary-medicine

Areas of laser application

When Shawlow and Townes (1958) published the construction plans for the laser and Maiman (1960) presented the first functional ruby-crystal laser to the scientific community, there was probably no inkling of the enormous range of applications and types that would develop from this invention. Today, lasers find an ever increasing new and varied range applications all over the world. The spectrum extends from the simple laser pointer via applications in measurement technology, soft-lasers for use in cosmetics, high-power industrial lasers, e.g. fixed lasers such as the Neodyne-YAG laser for welding car bodies (6 kW) or gas lasers such as the carbon dioxide laser (35 kW) for cutting and vaporising inch thick metal sheets; to extremely high energy lasers, which, linked together in hundreds of units, may one day provide the energy for plasma production in a fusion reactor. Modern diode lasers for examp le, find everyday uses in laser printing, CD-players, CD-ROM drives, bar-code scanners and in optical fibre phone lines, in which the signals are actually transmitted by laser.

Lasers in medicine

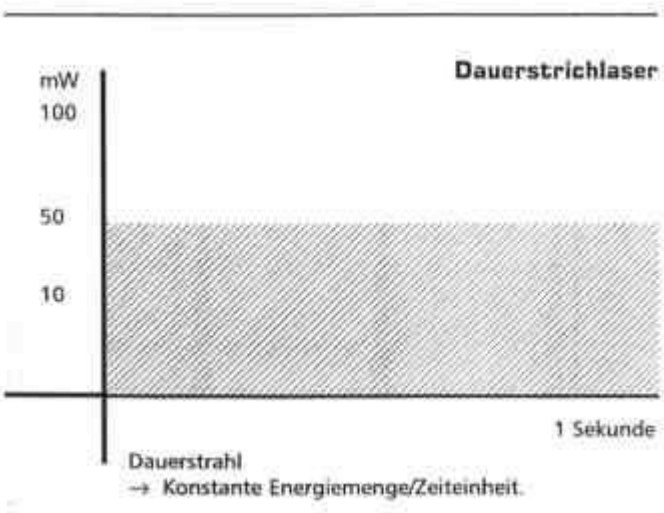
Different lasers are also used in many different areas of medicine. So far, the most well-known have been surgical lasers, used for incision and cauterisation in endoscopic surgery and for the treatment of ablatio retinae in the eye. In cosmetic surgery, lasers are used therapeutically for the sclerosing of varicose veins, the removal of birthmarks and brushmarks right through to the "vaporisation" of ageing skin layers and collagen production in exhausted subcutaneous tissue.

Therapy and acupuncture lasers

This paper, however, will give a report of a completely different medical application of laser devices, so-called "Mid-lasers". Low level laser therapy (LLLT) involves the local treatment of various tissues with so-called therapeutic lasers. These lasers are diode lasers with the great advantage of being very compact. The laser diodes are scarcely bigger than a match-head, so that the entire apparatus including the battery of a modern therapeutic laser can be housed in a device the size of a cigar.

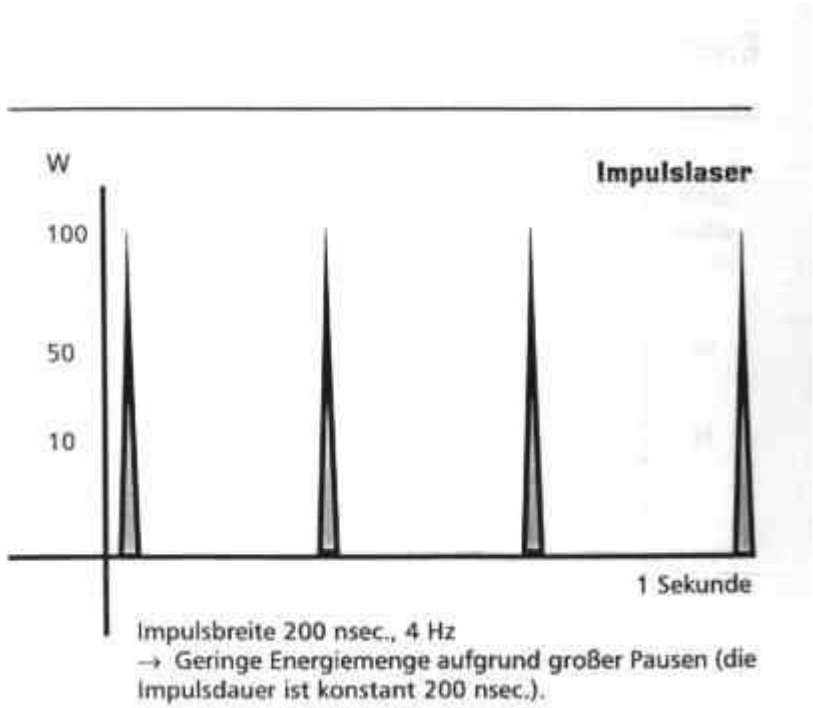
(Fig. 1 Handylaser Science 50 Watt Impulse) Thus, whether such a compact laser or a stand-alone device with a laser probe connected via cable (Fig. 2) is used, is actually a question of personal preference.

These devices basically work with wavelengths in the infra-red spectrum (600-900 nm). Two types must be distinguished here. On one hand, there are continuous beam lasers, which continually emit laser light. The output of these devices lies between 30 and 200 mW. The laser light emission can be split into different frequencies to attain optimal resonance in different types of tissue.



Contiusewave -laser, the Bahr- and Nogier -frequencies are modulated as a sinus wave on the basic laserbeam You see above.

The second type of laser is the pulse laser, with which light pulses of very high intensity (peak pulse power of 30 to 100 Watts) but very short duration (200 nsec) are emitted.



Light emission by impulselaser

Although the tissue penetration of laser light with these devices is very much higher, the short duration of the light beams means that no thermal or even coagulatory effects occur in tissues, even at pulse frequencies of up to 10000 Hz. To this end, primarily the Bahr and Nogier frequency ranges are used (Tables 1 and 2).

Table1 Bahr Frequencies Fr.1, 599,5Hz / Fr.2, 1199Hz / Fr.3, 2398Hz / Fr.4, 4796Hz / Fr.5,9592Hz / Fr.6, 149,9Hz / Fr.7, 299,8Hz Table 2 Nogier Frequencies Fr.A´, 292Hz / Fr.B´, 584Hz / Fr.C´, 1168Hz / Fr.D´, 2336Hz /Fr.E´, 4672Hz / Fr.F´ 9344Hz / Fr.G, 146Hz

A further advantage of the diode laser is its high level of efficiency. Whilst the Neodyne-YAG laser achieves 2-5% and the carbon dioxide laser 5-10% efficiency, diode lasers reach a level of efficiency of up to 55%. This also means that no costly cooling system need be installed, which would immediately reduce their ease of handling. It is for this reason that the diode laser has been adapted to form an industry standard device, by means of the optical coupling of hundreds of individual laser diodes. Lasers with an output of 2 kW have been produced, and 6 kW lasers are foreseen.

Function of the diode laser

With a diode laser, all the components can be accommodated in the smallest possible space, a fraction of a cubic millimetre. Semiconductor diodes are designed so that negatively charged, electron-rich and positively charged, low-electron layers are embedded in a crystal matrix. When an electric field is applied across the diode crystal, electrons move from the electron-rich N-layer to the electron-poor P-layer. In the laser active zone, only a few atom layers thick, photons are produced. The resonator is formed from two semiconductor layers which reflect the photons: a thin layer in

which every newly produced photon is forced to travel back and forth in phase with the existing photons, between the two mirrored end surfaces of the diode. Only when enough photons are oscillating in phase is their collective energy sufficient to emerge through the front, semi-permeable mirror of the diode as a laser beam. Results of investigations into the effective mechanisms of the therapeutic laser

Physiological basis of laser effects

Research by Popp which established that biophotons play a fundamental role in cell communication by means of so-called "ultra-weak cell radiation" is one of the most important pieces of primary research into laser effects. This involves coherent, in other words, laser light. The DNA in the cell nucleus can be established as the source of the radiation. These emissions occur in the infra-red to ultra-violet spectra. It was possible to determine in animal tumours that with increasing malignancy, the tumour cells lose their mutua l light contact. It is assumed that the coherence of the light emissions is also reduced by other pathological processes, increasing disorder emerges and the resonance necessary for communication is lost. The use of laser treatment may be practical here in order to re-establish order. Warnke has specifically made exploratory studies of the infra-red laser. According to these, approx. 70% of the laser energy is reflected from the skin surface, 15-20% of the entrant energy is dissipated and lost by diffusion in the body tissues. Thus only 5-10% of the laser energy is absorbed. Absorption is by means of a so-called "antenna pigment", the flavoprotein-metal-redox system, which forms an important link in the respiratory chain within the mitochondria. Here, absorbed laser photons are transformed directly into cellular energy. This is particularly beneficial for unhealthy cells and cells in tissue modified by illness, which have a particularly high energy requirement to perform their functions. The laser may play a decisive role by providing the necessary energy. Equally, an intense energy pulse in the nerve cells of the acupuncture points can lead to hyperpolarisation and thus to unblocking of irritations; whereby the demonstrable pain reduction can be attributed to the laser. The healing of wounds and repair of damaged ligaments are processes requiring high energy inputs. With laser light, the energy required for the breakdown of waste building blocks and the synthesis of new building blocks for wound closure can be provided more quickly and ligament or wound repair accelerated. Important investigations have been made by the pioneer of LLLT, E. Meister, on this topic, which demonstrated as early as 1969, that the proliferation of collagen threads and a marked increase in cell activity after 1-3 laser irradiation of wounds. The results justify the assumption that even in the area not directly irradiated, healing is significantly improved due to the increased diffusion of bioactive substances. I personally have almost 200 scientific publications on the effects of LLLT. I would like to select some investigations as representative of the majority of investigated and confirmed laser therapeutic effects. These established, inter alia, the following effects of clearly defined laser irradiation: vasodilatation with mast cell degranulation, activation of macrophages and lysozyme, increased circulation in occlusive arterial diseases, treatment of haemangioma, reduced blood pressure in hypertension, improved capillary circulation in micro circulatory conditions, applications for wound healing disruptions, analgesia, for spondylosis, skin-transplant surgery, for facial paralysis, regeneration of nerve lesions and inhibited nervous functioning. Further impressive research results are available in the areas of rheumatic therapy, lumbago, degenerative conditions of the joints, invasive procedures in bone marrow operations, dentistry and orthodontics, in orthopaedics, immunology, with low sperm counts, prostate conditions, sports injur ies, infected wounds, corneal ulcers and lesions, pain relief in herpid neuralgia. A particularly interesting study by T.KARU shows by means of in vivo tests on human capillary blood that laser therapy can considerably increase the clearance of peroxide radicals as measured by chemoluminescence. Interestingly, the maximum increase in clearance coincided at the peak of symptoms (viral infection), it was reduced once again during convalescence, and was no longer observable after recovery. It was also established that the rate of

increase was dependent on the pulse frequency of the laser radiation, the wavelength of the laser light used and the irradiation dosage .

Several investigations confirm a relation between dosage and effect to the extent that too small irradiation dosages have no positive effect, but then with increasing dosages an increased effect up to a maximum can be achieved. If the dosage is increased further, the stimulating effect is reduced until the previous, non-irradiated condition is reached again. Further studies show that a negative, destructive effect cannot be demonstrated, even with prolonged irradiation (30 minutes). Despite these extensive studies, the optimal laser power to be used for therapy and the length of treatment can still not be clearly established, since there is naturally a considerable difference between the shaved skin of the laboratory rat and the hairy skin of a dog or horse. On the basis of my own experience, one can presume an optimal effect on surface structures in veterinary medicine for laser output of 50-100 mW (continuous beam) or 50 - 100 W peak pulse power (pulse lasers) over an irradiation time of approx. 20 - 40 sec. For deeper structures, articular cartilage, ligaments, fistulae, sinusitis, the treatment duration must be increased to approx. 2-3 min. per point. The foregoing summary of the current state of knowledge in LLL therapy shows unambiguously that the laser may be used effectively for the local treatment of traumatised tissue as well as for acupuncture treatment. Optimal treatment for individual patients thus involves local laser irradiation in combination with appropriate acupuncture points. Indications for local laser therapy The following listing of indications for local laser therapy is derived from long years of personal experience involving real applications tested and successful on countless patients.

Healing of wounds

The most simple but nevertheless very effective indication for local laser therapy is the encouragement of wound healing after trauma or operations, in particular when a rapid resilience of the wound closure should be achieved or the wound is located in an area which is difficult to immobilise, such as joints. Even in many cases of infected wounds, where normally long-term drainage would be required after surgical intervention, per primam healing can often be expected after laser treatment and suture dehiscence avoided. With wounds with larger loss of skin surface or after the removal of larger areas of caro lux, wound closure normally occurs very quickly and without complications. With fistula formation and disturbance to the wound demarcation and above all for deep wounds, laser treatment is to be highly recommended. There have even been cases of old scars in which the demarcation had clearly not been closed, opening again after 1-2 laser treatments, cleaning themselves and finally closing up again.

Local inflammation

Traumatic Local laser treatment proved effective in the following trauma-related inflammatory conditions: acute distortion, capsule tearing, pulled muscles and haematoma. The treatment is also very effective in the treatment of acute and chronic inflammation of the pastern and of acute and chronic tendonitis. A markedly more rapid and complete reduction of accompanying tissue swelling and other symptoms of inflammation such as pain and heat also occurs.

Infectious Laser treatment is also exceptionally useful in infectious local inflammations. In very many cases phlegmonic processes, (Pic. 5+6) e.g. after the infection of wounds, in mastides and even in acute to sub-acute thrombophlebitis can be cured when previous treatment with antibiotics have proved ineffective. Laser irradiation also has an outstanding effect on the maturation and demarcation of abscesses. This applies, for example, to hoof ulcers or infected inflammations of the hoof dermis which do not mature and diffusely spread into the rest of the hoof dermis and which are

normally very difficult to manage. Purulent, acute and chronic sinusitis in dogs and even in horses can usually be effectively treated with laser irradiation, whereby in horses the affected tooth usually does not have to be extracted and the maxillary sinus does not have to be trepanned. Lastly, I would like to cite the highly effective option of treating infected joint (Pic. 7+8) and tendon sheath inflammations (Pic. 9+10+11) . At commensurate cost, in most cases excellent treatment success can be expected here.

phlegmonic processes, (Pic 5) after 10 days (Pic. 6)

infected joint (pic.7) after 8 days (pic 8)

tendon sheath inflammations. (pic9) after 2 days (pic 10), after 8 days (pic 11)

Orthopaedics

Laser treatment is used most frequently for spinal problems in horses and spondylosis in dogs. But in all conceivable forms of disability with a variety of causes, in most cases laser treatment is strongly indicated. Very often, costly and unreliable operations can thereby be avoided, and even conditions not cured or even made worse by operating can subsequently be alleviated.

Neurology

Principally, disability in dogs due to discopathy or trauma and in horses due to ataxia should be mentioned here. Both illnesses are very often curable, however often at not inconsiderable cost.

Eye conditions

With regard to eye conditions, it is principally treatment-resistant corneal injuries, ulcus corneae, corneal occlusion and also deep eye injuries which may be treated successfully.

Local laser treatment as the ideal introduction to acupuncture

If laser treatment of acupuncture points is used to target sympathetic vegetative and humoral control mechanisms, all the laser treatments listed above can be further improved in their effectiveness. Acupuncture may be started relatively easily in the areas listed above, using a rather small number of highly effective acupuncture points. The straightforward introduction and the possibility it offers of convincing oneself of the outstanding effectiveness of acupuncture in a considerable range of indicated conditions are strong factors motivating towards making the effort of learning more about this area. All colleagues who have taken this first step are astonished again and again by the really significant extension of therapeutic possibilities beyond the known and the hitherto accepted.