

pain relief

Magnetic therapy of the highest class

Home / pain relief

Pain treatment via stimulation of the body's opioid system

background

In the course of the "electrosmog discussion" and extensive study-based studies on negative effects of electromagnetic fields of natural or artificial origin, there is a wealth of contradictory results that describe both a lowering of the pain threshold and increase in pain sensitivity, as well as a decrease in pain.

For example, mice react with hyperalgesia during a magnetic storm, which makes them more sensitive to pain [1] . This also, for example, under fields of 0.5 Hz, 150 - 9 000 μ T, 30 min daily for 14 days - but only at night [2] . On the other hand, the perception of pain in snakes is blocked when exposed to a field of 60 Hz and 100 μ T during the day for 30 minutes over 6

days [3] . This can also be repeated in albino rats, where, for example, with extremely weak fields of 1 μT [4] or 2 μT [5] over 30 min, an analgesia occurs.

In humans, for example, continuous irregular frequencies (0.03-0.07 Hz) and a flux density of 20-70 μT after 2 hours reduce the pain threshold for skin irritation (19.1%) and reduce toothache by 9.1% [6] . Even 37 Hz, 80 μT (30 min), leads to a decrease in the pain threshold in the skin by 22.6% [7] . Similarly, a field of 40 Hz, 40 and 80 μT after 2 hours only reduces the pain threshold for toothache at 40 μT [8] .

Longer geomagnetic storms (6 days) increase the morphine effect (10 mg / kg) in mice, for example [9] . Also, artificial fields of 0.5 Hz, 150-9000 μT , 30 min over 14 days reduce the analgesic effect of morphine (10 mg / kg) after 5 to 10 days [10] .

Tests with the opiate antagonist naloxone show that in mice both naloxone and a field of 0.5 Hz, 150-9000 μ T after 30 min have the same analgesia-raising effect [11] . On the other hand, in albino rats, the analgesic effect of weak complex fields (1 μ T) is abolished by pre-injection of naloxone [12] . It is also surprising that, for example, a stress-induced hypoalgesia (when, for example, mice must swim in warm and cold water and the sensation of pain thereby decreases) is neutralized again by a field of 0.5 Hz, 150-9000 μ T, 30 min, here warm water even produces a stronger effect [13] .

This is again countered by a human trial that under 30-minute MF exposure, the pain threshold increases significantly compared to placebo [14] . This is also confirmed in mice in which an extremely low-frequency and low-intensity magnetic field (100 μ T) has a similar analgesic effect as a moderate morphine dose (5m / kg) [15] .

A review that deals almost exclusively with the pain-enhancing PEMF studies comes to the then unexpected conclusion that

these findings would provide new perspectives for the treatment of pain in humans [16] . And it is even more surprising when a Lawson Research Institute filed for a patent application in June 1996 (published Dec. 11, 1997), in which the inventors [17] , from both the individual studies and the review, quite well are known, a somewhat opaque "Electrotherapy device using low frequency magnetic pulses " describe for pain treatment. This is a coil that allows the treatment of pain on the extremities in the form of a kind of cuff.

As a result, a magnetic field hood is developed, behind which are called CNP (complex neural pulses). This is a low-frequency PEMF of very low flux density. Applicants refer to findings that a frequency-modulated magnetic field (100 μ T), for example, in snakes (*Capaea nemoralis*), a significant analgesia, ie pain attenuation generated [18] . This also occurs in rats when exposed to painful thermal stimuli [19] and also in humans by a previously cited study by Shupak NM et al.

Although the authors explain the underlying mechanism of action as poorly understood, there are indications that it is related to a "modulation" of the body's own opioid system. They also emphasize the influence that PEMF-induced mood enhancement has on influencing pain perception. Also the dopaminergic system obviously reacts to PEMF. For example, in a double-blind crossover study (0.4 - 1.1 mT), the pain threshold for skin sensation associated with PEMF increases by more than 50% [20] .

It is remarkable to note that the study participants were recruited from 90% women - confirming the results of the study Shupak, after the positive PEMF effects in women are clearly observed in a stronger expression. However, they found no evidence of an effect on the dopaminergic system, so that the result of analgesia by PEMF should not be related to the well. With regard to this inserted flux densities are in the range of <1 mT [21] , <500 nT (here especially at 120 Hz) [22] and even <50 nT [23] .

Mammals have a magnetic field receptor

From the above study it is also possible to deduce the important finding that mammals have a currently proven chemical magnetic field receptor (cryptochrome) [24] . This assumption has previously been expressed in connection with the analgesic phenomenon that occurred in snakes, which were temporarily exposed to PEMF [25] . Cryptochrome is actually a photosensitive protein that affects primarily circadian rhythms in plants and many fungi, flies and mammals. In mammals, cryptochrome occurs as a photosensitive pigment in the retina. In other tissues, however, it can also perform its function light-independently [26], By binding to cellular proteins, it is transported to the nucleus and controls the availability of transcription factors. This could also explain why PEMF effects are obviously also light-dependent.

explanation

Transcription factors synchronize the activity of the genes with the respective metabolic situation. In adult cells, they control growth, cell division and apoptosis via mRNA. There are so-

called activators that promote the activity of DNA polymerase and repressors with the opposite effect.

Evidence for the analgesic or opioid effects of PEMF is based on studies that describe, for example, an opioid receptor-mediated mechanism [27] . In a pharmacologically initiated anesthesia, the duration of action is prolonged via the magnetic field by activating the body's endorphin system and / or by increasing the activity of the opioid signaling pathways [28] .

It also appears that the ability of magnetic fields to control the central cholinergic system is also related to the activation of the opioid system. After all, it is possible to use the opioid receptor antagonist naloxone to reduce the decrease in magnetic field-induced choline uptake in the brain of rats [29] . Overall, this is of far-reaching importance because opioid peptides also act as growth modulators and control both cell differentiation and cell architecture of many tissues [30] , [31] , [32] .

In a cell culture study (heart muscle cells) a magnetic field exposure led to a significant increase in the expression of opioid genes. Also, a direct "irradiation" of isolated nuclei of cardiomyocytes showed that pro- dynorphine gene transcription was greatly increased [33] . This was done by activating the nuclear protein kinase. This also led to a sharp increase in the synthesis and secretion of dynorphin B.

Dynorphins are a group of endogenous opioid peptides, even in-body opioids. They play an important role in pain perception and pain suppression. Endogenous opioids include endorphins, enkephalins and dynorphins.

Magnetic field experiments with MFC-7 cells (breast cancer cells) show that the use of weak PEMF can produce the same analgesic effect as morphine. This is mainly due to an activity of the mu-opioid receptor. After the use of morphine derivatives themselves promotes metastasis [34] , the authors conclude that the treatment of pain should be based on magnetic fields of specific intensities and frequency patterns .

Conclusion

In addition to the effective model of an increase in blood flow, which can dissolve muscle contractions and thus play an important therapeutic role in musculoskeletal pain or myofascial syndromes, PEMF also appear to be centrally effective in the treatment of pain in the context of special intensities and frequencies via activation of the body's own opioid system (endorphins) be.

Sources

[1] Ossenkopp KP et al. Reduced nocturnal morphine analgesia in mice following a geomagnetic disturbance. *Neurosci Letters* 1983; 40: 321-325

[2] Cavaliers M et al. Magnetic fields abolish the enhanced nocturnal response to morphine in mice. *Physiol Behav* 1984; 32: 261-264

[3] Cavaliers M. Ossenkopp KP. 60 Hz magnetic field have analgetic effects in snails. *Brain Res* 1993; 620: 159-162

- [4] Ryczko MC, Persinger MA Increased analgesia to thermal stimuli in rats age letter exposures to complex pulsed 1 μ T magnetic fields. *Perceptual and Motor Skills* 2002; 95: 592-598
- [5] Martin LJ. Persinger MA. Spatial heterogeneity of the magnetic field during exposures to complex frequency-modulated patterns. *Percept engine skills*. 2003; 96: 1005-1012
- [6] Papi F et al. Exposure to oscillating magnetic fields influencing sensitivity to electrical stimuli, 2: experiments on humans. *Bioelectromagnetics* 1995; 16: 295-300
- [7] Ghione S et al. Human head exposure to a 37 Hz electromagnetic field: effects on blood pressure, somatosensory perception, and related parameters. *Bioelectromagnetics* 2004; 25: 167-175
- [8] Ghione S et al. Effects of 50 Hz electromagnetic fields on electroencephalographic alpha activity, dental pain threshold and cardiovascular parameters in humans. *Neurosci Letters* 2005; 382: 112-117
- [9] Ossenkopp KP et al. Reduced nocturnal morphine analgesia in mice following a geomagnetic disturbance. *Neurosci Letters* 1983; 40: 321-325

- [10] Cavaliers et al. Magnetic fields abolish the enhanced nocturnal response to morphine in mice. *Physiol Behav* 1984; 32: 261-64
- [11] Cavaliers M, Ossenkopp KP. Stress-induced opioid analgesia and activity in mice: inhibitory effects of exposure to magnetic fields. *PsyPharmacol* 1986; 89: 440-443
- [12] Martin LJ et al. Thermal analgesic effects from weak, complex magnetic fields and pharmacological interactions. *Pharmacol Biochem Behav* 2004; 78: 217-227
- [13] Cavaliers M, Ossenkopp KP. Day-night rhythms of opioid and non-opioid stress-induced analgesia: differential inhibitory effects of exposure to magnetic fields. *Pain* 1988; 32: 223-229
- [14] Shupak NM et al. Human exposure to a specific pulsed magnetic field: effects on thermal sensory at pain thresholds. *Neurosci Lett*. 2004 Jun 10; 363 (2): 157-62
- [15] Shupak NM et al. Analgesic and behavioral effects of a 100 microT CF-1 mice. *Neurosci Lett* 2004 Jan 2; 354 (1): 30-3
- [16] Del Seppia et al. Pain perception and electromagnetic fields. *Neurosci Biobehav Rev* 2007; 31: 619-642

- [17] Alex W. Thomas, Frank S. Prato, Martin I. Kavaliers, Michael A. Persinger. WO1997046277 A1
- [18] Thomas AW et al. Antinociceptive effects of a pulsed magnetic field in the land snail, *Cepaea nemoralis*. *Neurosci Lett* 1997; 222 (2): 107-10
- [19] Martin LJ, Koren SA, Persinger MA. Influence of a complex magnetic field application in rats upon thermal nociceptive thresholds: the importance of polarity and timing. *Int J Neurosci* 2004; 114 (10): 1259-76
- [20] Kortekaas R et al. A novel magnetic stimulator increases experimental pain tolerance in healthy volunteers - a double-blind sham-controlled crossover study. *PLoS One* 2013; 8 (4): e61926
- [21] Robertson JA et al. Evidence for a dose-dependent effect of pulsed magnetic fields on pain processing. *Neurosci Lett* 2010; 482 (2): 160-2
- [22] Prato FS et al. The detection threshold for extremely low frequency magnetic fields may be below 1000 nT Hz in mice. *Bioelectromagnetics* 2011; 32 (7): 561-9

- [23] Cuppen JJM et al. Immune stimulation in low frequency electromagnetic field. *Environmentalist* 2007; 27 (4): 577-583
- [24] Maeda K et al. Magnetically sensitive light-induced reactions in cryptochromes are consistent with their proposed role as a magnetoreceptor. *Proc Natl Acad Sci USA* 2012; 109 (13): 4774-9
- [25] Prato FS, Cavaliers M, Thomas AW. Light-dependent an-indefinite behavioral effects of extremely low frequency magnetic fields in a land snail are consistent with a parametric resonance mechanism. *Bioelectromagnetics* 1997; 18 (3): 284-91
- [26] *Komplexlexikon der Biologie. A to Fotoma. Bd. 1.*
Publisher: Spektrum. ISBN: 382741041
- [27] Thomas AW et al. *Peptides* 1997; 18: 703-709
- [28] Rojavin MA, Ziskin MC. Electromagnetic millimeter-waves increase the duration of anesthesia caused by ketamine and chloral hydrates in mice. In *J Radiat Biol* 1997; 72: 475-480
- [29] Lai H et al. Effects of a 60-Hz magnetic field on central cholinergic systems of the rat. *Bioelectromagnetics* 1993; 14: 5-15

- [30] Zagon IS et al. Distribution of enkephalin immunoreactivity in germinative cells of developing rat cerebellum. *Science* 1985; 227: 1049-1051
- [31] McLaughlin PJ. Regulation of THEN sythesis of myocardial and epicardial cells in developing rat heart by enkephalin. *At J Physiol* 1996; 271: R122-R129
- [32] Zagon IS et al. Opioid growth factor modulates corneal epithelial outgrowth in tissue culture. *At the J Physiol.* 1995; 268: R942-R950
- [33] Ventura C et al. Eleven-pulsed magnetic fields modulate opioid peptide gene expression in myocardial cells. *Cardiovasc Res* 2000; 45: 1054-1064
- [34] Simon RH Arbo TE. Morphine increases metastatic tumor growth. *Brain Res Bull* 1986; 16: 363-367