

Topic:

Demonstration of the effectiveness of the magnetic field therapy in various diseases of humans through double blind placebo - controlled randomized trials and other controlled studies

Literature overview:

** The treatment with pulsating magnetic field seems to be superior because of **double blind controlled randomized** studies of the **Placebo-treatment**.

* The treatment with pulsating magnetic field seems to be superior because of the **controlled** studies of the **control-treatment**.

1. *Aaron RK, Lennox D, Bunce GE, Ebert T: The conservative treatment of osteonecrosis of femoral head. A comparison of core decompression and pulsating electromagnetic fields. Clin Orthop 1989; 249:209-218.
2. *Bilotta TW, Zati A, Mignani A, Mari G, Davoli O, Zucchini E. Pulsed electromagnetic field therapy for postmenopausal osteoporosis. 1993, Electricity and Magnetism in Biology and Medicine; San Fransisco press, San Fransisco CA; 761-763
3. **Binder A, Parr G, Hazleman B, Fitton Jackson S: Pulsed electromagnetic field therapy of persistent rotator cuff tendinitis. A double-blind controlled assessment. Lancet 1984; 1:695-698.
4. **Borsalino G, Bagnacani M, Bettati E, et al: Electrical stimulation of human femoral intertrochanteric osteotomies. Clin Orthop 1988; 237:256-263.
5. **Capanna R, Donati D, Masetti C, et al: Effect of electromagnetic fields on patients undergoing massive bone graft following bone tumour resection. A double-blind study. Clin Orthop 1994:213-221.
6. **Eyres KS, Saleh M, Kanis JA. Effect of pulsed electromagnmctic fields on bone formation and bone loss during limb lengthening. Bone 1996, 18: 505-509
7. *Ganguly KS, Sarkar AK, Datta AK, Rakshit A. A study of the effects of pulsed electromagnetic field therapy with respect to serological grouping in Rheumatoit arthritis. J. Indian Med. Assoc., 1998; 96, 272-5
8. *Giordano N, Battisti E, Geraci S, Santacroce C, Lucani B, Fortunato M, Mattu G, Gennari C. Analgesic-antiinflammatory effect of a 100 Hz variable magnetic field in RA. Clin. Exp. Rheumatolog, 2000, 18(2): 263
9. **Ieran M, Zaffuto S, Bagnacani M, Annovi M, Moratti A, Cadessi R. Effect of low frequency pulsing electromagnetic field on skin ulcers of venous origin in humans: a double-blind study. J. Orthop. Res. 1990, 276-282.
10. **Kennedy WF, Roberts CG, Zuege RC, Dicus WT: Use of pulsed electromagnetic field in treatment of loosened cemented his prostheses. A double blind trial. Clin Orthop 1993; 198-205.
11. **Mammi GI, Rocchi R, Cadossi R, Massari L, Traina GC: The electrical stimulation of tibial osteotomies. Clin Orthop 1993; 246-253.
12. **Mooney V: A randomized double-blind prospective study of the efficacy of pulsed elecromagnetic fields for interbody lumbar fusions. Spine 1990; 15:708-712.
13. **Nielsen JF, Sinkjaer T, Jakobsen J: Treatment of spasticity with repetitive magnetic stimulation; a double-blind placebo-controlled study. Mult. Scler. 1996;2:227-232
14. **Pages IH, Hermann H, Conradi E: magnetic field therapy of chronic degenerative diseases of the musculoskeletal system. Z Physiother 1985;37:21-24 (single blind, placebo controlled)

15. **Pascual-Leone A, Rubio B, Pallardo F, Catala MD. Rapid-rate transcranial magnetic stimulation of left dorsolateral prefrontal cortex in drug-resistant depression. *Lancet*, 1996; 347: 233-237
16. **Pujol J, Pascual-Leone A, Dolz C, Delgado E, Dolz JL, Aldoma J. The effect of repetitive magnetic stimulation on localized musculoskeletal pain. *Neuroreport* 1998, 9(8): 1745-8
17. **Richards TL, Lappin MS, Acosta UJ, et al: Double-blind study of pulsing magnetic field effects on multiple sclerosis. *J Altern. Complement Med* 1997;3:21-29
18. **Roland NJ, Hughes JB, Daley MB, Cook JA, Jones AS, McCormick MS. Electromagnetic stimulation as a treatment for tinnitus: a pilot study. *Clin Otolaryngol*. 1993, 18, 278-281
19. **Sharrard WJ: A Double-Blind Trial of Pulsed Electromagnetic Fields for delayed Union of Tibial Fractures. *J Bone Joint Surg Br* 1991;72B:347-355.
20. *Skoromets AA, Nikitina VV. Magnetic Stimulation in the recuperative therapy of patients with spondylogenic diseases of the nervous system. *Neuroscience and Behavioral Physiologie* 1999, 29(2) 211-215.
21. **Stiller MJ, Pak GH, Shupack JL, Thaler S, Kenny C, Jondreau L: A portable pulsed electromagnetic field (PEMF) device to enhance healing of recalcitrant venous ulcers: a double – blind, placebo-controlled clinical trial. *Br J Dermatol* 1992; 127:147-154.
22. *Tabrah F, Hoffmeier M, Gilbert F, Batkin S, Bassett CAL. Bone density changes in osteoporosis-prone women exposed to pulsed electromagnetic field (PEMFs). *J. Bone Mineral Research* 1990; 5(5), 437-442
23. *Tabrah FL, Ross P. Hoffmeier M, Gilbert F. Clinical Report on Long-term Bone density alters after a short-term of EMF Application. *Bioelectromagnetics* 1998, 19: 75-78
24. **Trock DH, Bollet AJ, Dyer RHJr, Fielding LP, Miner WK, Markoll R: A double-blind trial of the clinical effects of pulsed electromagnetic fields in osteoarthritis (see comments). *J Rheumatol* 1993; 20:456-460.
25. **Trock DH, Bollet AJ, Markoll R: The effect of pulsed electromagnetic fields in the treatment of osteoarthritis of the knee and cervical spine. Report of randomized, double-blind, placebo controlled trials. *J Rheumatol* 1994;21:1903-1911.

^{Review} Gossling HR, Bernstein RA, Abbott J: Treatment of ununited tibial fractures: a comparison of surgery and pulsed electromagnetic fields (PEMF). *Orthopedics* 1992; 15:711-719

^{Review} Pool R. Electromagnetic fields: the biological evidence. *Science* 1990, 249: 1378-81

^{Review} Quittan M, Schuhfried O, Wiesinger GF, Fialka-Moser V. Clinical effectiveness of the magnetic field therapy – a literature overview. *Acta Medica Austria* ca 2000, 27(3), 61-68

Description of the most authoritative studies to the indications (alphabetically):

	<u>Arthritis** , Polyarthritis</u>
Authors, title of the study and source	<u>Trock DH</u> , Bollet AJ, Dyer RHJr, Fielding LP, Miner WK, Markoll R: A double-blind trial of the clinical effects of pulsed electromagnetic fields in osteoarthritis. J Rheumatol 1993; 20:456-460.
Number of patients	27
Disease	Inflammation in the joint: knee, hand- dinger- joints, ankle after an accident.
Treatment	Pulsating, 30 HZ, 10-20 G, 30 min. 18 times within 1 month. Follow up check without treatment: 1 month.
Improvement	61 % in Verum vs. 18 % in placebo. Pains diminished, function was better.
Remarks	Upon completion of the treatment the positive effect lasted still for at least another month. Possible explanation: change in the hormone production or activity of nerves and neurotransmitters and their signals. Fibroblasts (produce connective tissue), chondrocytes (cartilage formation), Osteocytes (bone formation), mRNA (delivery of commands of the genetic material to the producers of protein), spec. protein synthesis

	<u>Osteoarthritis ** , Joint pain, Chronic arthritis, Cervical spine disorders, Gonarthrosis</u>
Authors, title of the study and source	<u>Trock DH</u> , Bollet AJ, Markoll R: The effect of pulsed electromagnetic fields in the treatment of osteoarthritis of the knee and cervical spine. Report of randomized, double blind, placebo controlled trials. J Rheumatol 1994; 21:1903-1911.
Number of patients	167
Disease	86 abrasion of the knee; 81 abrasions of the cervical spine with intervertebral stenosis, new bone formation at the articular surface (osteophytes), cartilage lesions (subchondral Sclerosis). Disease existed for more than 7 years
Treatment	Pulsating, 5 – 25 Hz (rectangular) ascending in three steps of 10 min, 10-20 G, 30 min. 18 times within 1 month. Follow up check without treatment: 1 month.
Improvement	Highly significant improvement of pain at rest, pain in motion, pressure pain, less restriction of movement in flex/stretch or twirling, both subjectively and objectively.
Remarks	The improvement was noticeably better than with the usual drug therapy. The MFT has cartilage protective and regenerating, which is also the approach of a new pharmaceutical therapy! Although, as is well known, for arthritis and osteoarthritis the placebo effect is great but the treatment was much better. After one month of completion the therapy group was still feeling better.

	<u>Depression**</u>
Authors, title of the study and source	<u>Pascual-Leone A</u> , Rubio B, Pallardo F, Catala MD. Rapid-rate transcranial magnetic stimulation of left dorsolateral prefrontal cortex in drug-resistant depression. Lancet, 1996; 347: 233-237
Number of patients	17, multiple cross-over (per cycle, per patient randomised Verum or placebo)
Disease	Unipolar (=not manic) depression, resistant to medication, psychotic Suptype DSM-III-R)
Treatment	Once daily I, 5 days in a row per month, 5 month. randomised Verum or placebo. transcranial. 10 Hz, 90% intensity („motor threshold“)
Improvement	Highly significant improvement, which lasted 2 weeks after a 5-day treatment. No adverse side effects.
Remarks	The authors consider this therapy as a promising alternative to conventional therapy (electroconvulsive treatment)

	<u>Inflammation of the tendons and muscle onset **</u> , <i>Capsular injuries, Shoulder -arm syndrome, Chronic shoulder pain, endinitis, tendon injury</i>
Authors, title of the study and source	<u>Binder A</u> , Parr G, Hazleman B, Fitton Jackson S: Pulsed electromagnetic field therapy of persistent rotator cuff tendinitis. A double-blind controlled assessment. Lancet 1984;1:695-698.
Number of patients	29 patients where no other conventional therapy with corticosteroids or could be helped.
Disease	Persistent shoulder capsule and tendon inflammation
Treatment	4 weeks of blind randomized placebo or MFT therapy, after that all patients received MFT during 4 weeks, all patients were observed after 8 weeks again. 73 +/- 2 Hz.; 27 G.
Improvement	72 % had no more symptoms (no pain, no restriction of movement), 10.5% had minimal residual symptoms, 7 % maintained a spot of pain, 10.5% could not be cured with MFT. During the placebo treatment no improvement showed in any of the patients.
Remarks	These patients had already been in 3 months of intractable shoulder pain with severe limited movement. The effect of therapy has already set in after 4 weeks of MFT and continued. Patients who had no success were craftsman. The nature of the load was held responsible for treatment failure. In these 72 %, were cure, no relapses occurred within 4 months! It is expected that the MFT will help with other capsule and tendon inflammation.

	<u>Inflammation of the tendons and muscle onset **</u> , <i>Capsular injuries, Shoulder -arm syndrome, Chronic shoulder pain, Tendinitis, Tendon injury, Pain of the musculoskeletal system, Myalgia</i>
Authors, title of the study and source	<u>Pujol J</u> , Pascual-Leone A, Dolz C, Delgado E, Dolz JL, Aldoma J. The effect of repetitive magnetic stimulation on localized musculoskeletal pain. Neuroreport 1998, 9(8): 1745-8
Number of patients	30
Disease	Musculoskeletal pain
Treatment	40 min. one time
Improvement	MFT group: 59 % decrease in pain intensity, placebo: 14 %. The improvement was usually maintained for several days.
Remarks	Various diagnoses with musculoskeletal pain is included in this study (shoulder capsule injury, tennis elbow, nerve compression, carpal tunnel syndrome, spasms of the back muscles and leg muscles, osteoarthritis of the knee and the ankle joint, tendinitis).

	<u>Lumbago (Sciatica)**</u>
Authors, title of the study and source	Pages IH, Hermann H, Conradi E: Magnetic field therapy of chronic degenerative diseases of the musculoskeletal system. Z Physiother 1985;37:21-24
Number of patients	28 (between 22 – 77 years)
Disease	Sciatica
Treatment	Sinus, max. 240 G, 50/60 Hz., daily 20 min. 5 days
Improvement	36% were free of pain; another 50% reported a strong improvement of the pain. 14% remained unchanged and no one (0%) deteriorated. (in the control group who did not know whether they received the therapy or the placebo treatment, these numbers are respectively 14, 29, 50, 7 %)
Remarks	In the MFT group 86% were successful vs. 43% in the placebo group. Obviously the importance here is the spontaneous recovery. With MFT, however, this can be increased by 100%.

	<u>Hip joint abrasion (Coxarthrosis)**,</u> <i>hip joint pain</i>
Authors, title of the study and source	Pages IH, Hermann H, Conradi E: Magnetic field of chronic degenerative diseases of the musculoskeletal system Z. Physiother 1985;37:21-24
Number of patients	34
Disease	Coxarthrosis
Treatment	Sinus, max. 240 G, 50/60 Hz., daily 20 min. 5 days
Improvement	Pain intensity was measured. The MFT group was free of pain 29.4%, better 64.7%, unchanged 5.9 %, worse 0 % The blind placebo treated group: Free of pain 17.6%, better 5.9%, unchanged 64.7%, worse 11.8%
Remarks	The MFT group thus 94.1 % successful vs. 23.5 % in the placebo group

	<u>Hip joint implants easing (relaxation)**</u>
Authors, title of the study and source	<u>Kennedy WF</u> , Roberts CG, Zuege RC, Dicus WT: Use of pulsed electromagnetic field in treatment of relaxed cemented hip implants. A double blind trial. Clin Orthop 1993;198-205
Number of patients	37
Disease	Hip implants easing. Several underlying diseases were a cause for hip implants. Normal 32% of all hip replacements are loose within 10 years.
Treatment	Daily > 8 hours (overnight), 15 Hz burst pulses. 6 months.
Improvement	53% of the treatment group vs. 11% of the placebo group showed clinically relevant improvements.
Remarks	<p>After completion of the MFT of some patients one relapse showed after successfully treated. They were further recommended to have an hour of MFT daily. Apparently it was not long enough, because after 32 months there was one relapse by all patients. The conclusion is therefore:</p> <ul style="list-style-type: none"> - either MFT is used, to gain time before surgery - the MFT is not broken up after 6 months but treatment continue. <p>The authors continue to leave the possibility open that other MFT settings could be better (not topic of this study).</p>

	<u>Femoral Head Necrosis*</u>
Authors, title of the study and source	<u>Aaron RK</u> , Lennox D, Bunce GE, Ebert T: The conservative treatment of osteonecrosis of a vascular necrosis of the femoral head. A comparison of core decompression and pulsating electromagnetic fields. Clin Orthop 1989;249:209-218.
Number of patients	116
Disease	Osteonecrosis of the femoral head
Treatment	72 Hz, Pulse, 8 hours per day (over night), 12 to 18 months. Follow up: 24 months.
Improvement	MFT: Clinical improvement (pain, mobility) at 68% vs. 44% in the control group; MFT In this disease the bone tissue collapses by x-ray: Only 13 % in the MFT group vs. 42% in the control group had this phenomenon. When the disease was not so distinct, the differences were even greater. A lot of patients, who were treated with MFT, still had the improved function after 5 years.
Remarks	Osteonecrosis occurs predominantly in young adults and develops in 80-90% within 3 years into osteoarthritis with a serious disability. Conservative (= "non-surgical) therapies do not show satisfactory results. Here, the decompression (removal of part of necrosis) was used as a control treatment.

	<u>Knee joint abrasion (Gonarthrosis)**</u>
Authors, title of the study and source	<u>Pages IH, Hermann H, Conradi E</u> : Magnetic field therapy of chronic degenerative diseases of the musculoskeletal system. Z Physiother 1985;37:21-24
Number of patients	60
Disease	Gonarthrosis
Treatment	Sinus, max. 240 G, 50/60 Hz., daily 20 min. 5 days
Improvement	Pain intensity was measured. In the MFT group Free of pain 66,7%, better 33,3%, unchanged 0%, worse 0 % In the blind placebo treated group: Free of pain 23,3%, better 6,7%, unchanged 63,3%, worse 6,7%
Remarks	In the MFT group thus 100 % successful vs. 30 % in the placebo group.

	<u>Delayed fracture healing**</u>
Authors, title of the study and source	<u>Sharrard WJ</u> : A Double-Blind Trial of Pulsed Electromagnetic Fields for Delayed Union of Tibial Fractures. J Bone Joint Surg Br 1991;72B:347-355
Number of patients	45
Disease	Delayed healing of tibia fracture for > 16, however < 32 weeks.
Treatment	Plaster for all 15 Hz, rectangular, 12 pcs/day, (over night), 12 weeks
Improvement	Both radio logically and clinically significant improvement in the MFT group after 12 weeks of treatment
Remarks	Multicenter Study (16 centres). The author has already made earlier double-blind studies of bone fractures, (Barker, Lancet 1984), where no MFT effect could be detected. Here he lists the reasons: The fractures arose more than one year before the treatment and were never cured (too long), the groups were not fully comparable, and the fractures had been treated mainly in different manners, and the placebo treatment also had MF activity. The author believes that this present study demonstrates the effectiveness completely. Explanation: effects on calcium balance and calcium on collagenous and Proteoglycan development and vascularisation

	Bone healing after bone surgery**
Authors, title of the study and source	<u>Borsalino G</u> , Bagnacani M, Bettati E, et al: Electrical stimulation of human femoral intertrochanteric osteotomies. Clin Orthop 1988; 237:256-263.
Number of patients	31
Disease	Degenerative osteoarthritis of one or both hips(s)
Treatment	Reconstruction and surgical change of state in the femoral head. MFT 75 Hz, 18 gauss, 8 pcs/day, 3 months.
Improvement	The MFT group showed a highly significant increase in callus formation and trabecular bridging of the osteotomy position.
Remarks	The authors believe therefore that this study is very important, because they have the opinion that the bone healing after bone surgery is a chapter on its own and that the bone healing is not to be compared with fresh fractures or with delayed fractures.

	Bone healing after bone surgery **
Authors, title of the study and source	<u>Mammi GI</u> , Rocchi R, Cadossi R, Massari L, Traina GC: The electrical stimulation of tibial osteotomys. Clin Orthop 1993;246-253.
Number of patients	40
Disease	Degenerative Arthritis of the knee.
Treatment	Surgery in the lower part of the knee joint. MFT: 8 pcs/day, 60 days. 75 Hz.
Improvement	Radiographic evaluation after 60 days: Placebo group showed common healing. MFT group: 72.2 % showed more advanced healing.
Remarks	Authors believe that this data is a clear demonstration of efficiency of MFT, also for these bones surgery the process is as already described for the hip surgery (Borsalino 1988)

	<u>Bone transplantation (fusion two vertebrae through)**</u>
Authors, title of the study and source	<u>Mooney V</u> : A randomized double-blind prospective study of the efficacy of pulsed electromagnetic fields for inter body lumbar fusions. Spine 1990;15:708-712
Number of patients	195, Multicentre
Disease	Necessity of the vertebra fusion through: slipped disc, Spondylolisthesis, inter vertebral disc degeneration, failure of previous methods of fusion, spinal canal constriction and other diseases
Treatment	8 pcs/day,
Improvement	In 92.2% of patients in the MFT group, a radio logically detected fusion occurred after the bone grafting, versus 67.9% in the placebo group. Factors such as gender, age, level of fusion, number of transplants, Transplantation type, and internal fixation had no influence. Smoking had a small negative effect on the healing
Remarks	Confirmed by other studies, which describe the effectiveness of MFT with many bone –ligaments and wound healing problems.

	<u>Bone transplantation after bone tumour resection **</u>
Authors, title of the study and source	<u>Capanna R, Donati D, Masetti C, et al</u> : Effect of electromagnetic fields on patients undergoing massive bone transplantation following bone tumour resection. A double-blind study. Clin Orthop 1994:213-221
Number of patients	47
Disease	Removal of malignant processes of bone with subsequent bone transplantation of various kind
Treatment	75 Hz, 8 pcs/day, 12 months
Improvement	MFT had no effect when the total number of patients were compared within the groups, but in the sub-group which had no chemotherapy (9 in each group),the healing time of the MFT group was significantly shorter (6.7 months versus 9.4 months)
Remarks	The authors present the hypothesis that the MFT cannot be effective if the cell growth is suppressed by the chemotherapy. The authors consider the MFT for completely risk-free and quote cell studies and studies on humans with cancer (including brain tumours), which demonstrate that MFT causes no tumour growth and causes no side effects or adverse cases.

	<u>Back pain**</u>, <i>lumbar syndrome, Lumbago, back pain</i>
Authors, title of the study and source	<u>Pages IH</u> , Hermann H, Conradi E: magnetic field of chronic degenerative diseases of the musculoskeletal system. Z Physiother 1985;37:21-24
Number of patients	40
Disease	Lumbago
Treatment	Sinus, max. 240 G, 50/60 Hz., daily 20 min. 5 days
Improvement	Pain intensity was measured. In the MFT group Free of pain 35%, better 50%, unchanged 15%, worse 0 % In the blind treated Placebo group: Free of pain 25%, better 10%, unchanged 60%, worse 5%
Remarks	In the MFT group thru 85 % successful vs. 35 % in the Placebo group

	<u>Muscle spasms**</u>, <i>muscle cramps, tension</i>
Authors, title of the study and source	<u>Nielsen JF</u> , Sinkjaer T, Jakobsen J: Treatment of spasticity with repetitive magnetic stimulation; a double-blind placebo-controlled study. Mult. Scler. 1996;2:227-232
Number of patients	38
Disease	Multiple Sklerosis
Treatment	25 min., 2 /day, / day by day, 7.000 G, 8-25 Hz.
Improvement	MFT group: 78 % improved on clinical symptoms such as spasms (muscle cramps), vs. 18 in the control group.
Remarks	The anticonvulsant effect persisted 8 days after the therapy ended. As the traditional anticonvulsant therapies are medicinally, and side effects such as dizziness, sleepiness and so on, the authors see the MFT as a good alternative.

	<u>Multiple Sclerosis**</u>
Authors, title of the study and source	<u>Richards TL</u> , Lappin MS, Acosta UJ, et al: Double-blind study of pulsing magnetic field effects on multiple sclerosis. J Altern. Complement Med 1997;3:21-29
Number of patients	30
Disease	Multiple Sclerosis
Treatment	10 – 24 pcs /day, 2 months. 4-13 HZ, unipolar, 50-100 milli Gauss. The MFT device was attached to one of 3 acupuncture points on the shoulder, back and hip.
Improvement	Significant improvement of bladder control, cognitive functions, movement, facial balance and decrease in fatigue and spasticity. Also the EEG has improved during speech.
Remarks	Authors consider these results as very promising, but they think that longer treatments are yet to bring better results. The effect on the EEG is remarkable, since the MFT treatment was performed on the body. The hypotheses of the authors are that, receptors send from the body to the brain either through sympathetic skin or through meridians. Funded by the national Institute of Health.

	<u>Nerve injury*, musculoskeletal pain, Polyneuropathy, Radiculopathy, spinal cord injury</u>
Authors, title of the study and source	Skoromets AA, Nikitina VV. Magnetic Stimulation in the recuperative therapy of patients with spondylogenic diseases of the nervous system. Neuroscience and Behavioral Physiologie 1999, 29(2) 211-215
Number of patients	163 MFT; 92 control therapy, 20 healthy patients were 19 – 72 years old and had the disease between several month to 32 years.
Disease	Nervous disorder in 4 sirus rising characteristics, variations of the spinal columnentails.
Treatment	10.000 G, 40 Hz, 10 min. 10 to 12 treatments.
Improvement	In the group with the lowest characteristics was a 84.5%, significant improvement noted after one treatment. After 3 to 5 days the pain, briskness and chill were gone. In the middle group, the pain disappeared in 94.5% after completion of therapy. Reflexes and feelings (sensitivity) normalized by 50%. In the most seriously affected group was in 54% improvement detected. Furthermore the circulation with thermography, the blood flow characteristics was chemically measured with Rheography, the irritant passing with electromyelography, the anti-Oxidants state (protection for oxygen). These parameters showed significant improvements.
Remarks	Authors presume that the MFT exerts its effect on the paramagnetic free radicals (reduction of lipid peroxide products, increase in Antioxidant protection)

	<u>Osteoporosis due to inactivity**</u>
Authors, title of the study and source	Eyres KS, Saleh M, Kanis JA. Effect of pulsed electromagnetic fields on bone formation and bone loss during limb lengthening. Bone 1996, 18: 505-509
Number of patients	13
Disease	Operative leg lengthening (by 9 – 19 year old patients)
Treatment	15 Hz, rectangular, 4pcs/day, as long as the distraction lasted (< 12 months)
Improvement	(DXA measurement) bone loss due to immobilization could be reduced by MFT: Above the surgical position a significant increase in bone density in the MFT group was measured after 3 months, which lasted until the end of the study (12 months). Below the surgical position, bone density decreased in both groups, but significantly less in the MFT: after 2 months: MFT 10% loss of bone density, control 33% after 3 months: MFT 13% loss of bone density, control 54%
Remarks	It is believed that the MFT settings can be better selected so that the possibilities of therapy can be eminent.

	<u>Osteoporosis (Postmenopausal)*</u>
Authors, title of the study and source	<u>Tabrah F</u> , Hoffmeier M, Gilbert F, Batkin S, Basset CAL. Bone density changes in osteoporosis-prone women exposed to pulsed electromagnetic field (PEMFs). J Bone and Mineral Research 1990; 5(5), 437-442
Number of patients	20
Disease	Postmenopausale Osteoporosis
Treatment	10 pcs/day (overnight), 12 weeks, 72 Hz, 28,5 G. One Arm was treated with MFT, the other wasn't.
Improvement	Bone density measured on the forearm, increased significantly. Within 12 months after completion of therapy, this effect decreased again.
Remarks	The authors think that this therapy is really suitable as a full- body therapy for clinical use for prevention and treatment of osteoporosis. They believe that the treatment should be continued, rather than, as here, stopped after 12 weeks.

	<u>Osteoporosis (Postmenopausal)*</u>
Authors, title of the study and source	<u>Tabrah FL</u> , Ross P. Hoffmeier M, Gilbert F. Clinical Report on Long-term Bone density after short-term EMF Application. Bioelectromagnetics 1998, 19: 75-78
Number of patients	20
Disease	Postmenopausale Osteoporosis
Treatment	10 pcs/day, 12 weeks, 72 Hz, 28,5 G. One Arm was treated with MFT, the other wasn't.
Improvement	Bone density measured on the forearm, increased significantly. Within 3 months after the therapy, this effect decreased again and after 8 years there was no difference between the treated and the untreated area.
Remarks	The authors think, that this therapy is in combination with other therapeutic approaches appropriate

	<u>Osteoporose (Postmenopausal) *</u>
Authors, title of the study and source	<u>Bilotta TW</u> , Zati A, Mignani A, Mari G, Davoli O, Zucchini E. Pulsed electromagnetic field therapy for postmenopausal osteoporosis. 1993, Electricity and Magnetism in Biology and Medicine; San Fransisco press, San Fransisco CA; 761-763
Number of patients	100
Disease	Postmenopausale Osteoporosis
Treatment	Sinus, monodirectional, 50 G, 50 – 100 Hz, 30min/day, daily, 4x20 days within 2 years (that means 20 days per half a year). SPA measurement radius. MFT was compared with control and with nasal calcitonin 110 E.
Improvement	The untreated control group showed a 3% bone loss after 2 years. Only MFT: 1,44 % bone loss, only calcitonin 0,42 % bone growth; MFT plus calcitonin: 2,3 % bone growth.
Remarks	The combination of MFT with hormones seems to be the best treatment method.

	<u>Rheumatism (chronic)*</u>
Authors, title of the study and source	Giordano N, Battisti E, Geraci S, Santacroce C, Lucani B, Fortunato M, Mattu G, Gennari C. Analgesic-antiinflammatory effect of a 100 Hz variable magnetic field in RA. Clin. Exp. Rheumatolog, 2000, 18(2): 263
Number of patients	20. 10 rheumatoid patients and 10 healthy volunteers were treated with MFT.
Disease	Rheumatoid Arthritis
Treatment	Sinus, 100 Hz, 30 min. one time.
Improvement	In the patient group the reactive oxygen radicals declined, also PGE2 (prostaglandin is responsible for inflammation), c-AMP (measure of the influence of the MFT on the cell wall) increased in both groups.
Remarks	In the patient group the erythrocyte sedimentation rate and CRP didn't change, because only a 30 min treatment was carried out. The endorphin release (the body's own anti-pain hormone) showed no change, as well as the cortisol and ACTH (which is the hormone that induces cortisol secretion). The conclusion is that there is pain relief through the MFT not in the brain but rather in the field of neural pathways.

	<u>Rheumatoid Arthritis*</u>
Authors, title of the study and source	Ganguly KS, Sarkar AK, Datta AK, Rakshit A. A study of the effects of pulsed electromagnetic field therapy with respect to serological grouping in Rheumatoid arthritis. J. Indian Med. Assoc., 1998; 96, 272-5
Number of patients	24
Disease	Rheumatoid Arthritis exists from 1 – 20 years. Two patient groups: one with rheumatoid factor increases and one without.
Treatment	15 min / day/ joint, 3 days a week, 20 weeks. Rectangular.
Improvement	In pain, pressure pain, swelling, restricted movement came to a 50% or more improvement. In the group with elevated rheumatoid factor, the positive effects occurred later (after 2 months). In both groups the improvements held on after the end of therapy and remained until the end of the study (18 months). Even the joint deformation was better in the rheumatoid factor positive group by 10%, in the rheumatoid factor negative group by 50%.
Remarks	The improvements of the MFT are referred to the inhibition of tissue damage with all the consequences of the symptoms. Furthermore, it is argued that also the (auto-) immunological processes which contribute to the disease will be relieved by MFT.

	Musculoskeletal pain ** , Myalgia, inflammation of the muscle insertions and tendons, capsular injuries, shoulder-arm syndrome, chronic shoulder pain, tendinitis, tendon injury
Authors, title of the study and source	<u>Pujol J</u> , Pascual-Leone A, Dolz C, Delgado E, Dolz JL, Aldoma J. The effect of repetitive magnetic stimulation on localized musculoskeletal pain. Neuroreport 1998, 9(8): 1745-8
Number of patients	30
Disease	Musculoskeletal pain
Treatment	40 min. one time
Improvement	MFT group: 59 % decrease in pain intensity, placebo: 14 %. The improvement usually held on for several days.
Remarks	Various diagnoses with musculoskeletal pain are included in this study (shoulder capsule injury, tennis elbow, nerve compression, carpal tunnel syndrome, spasms of the back muscles and leg muscles, osteoarthritis of the knee and the ankle joint tendinitis).

	Tennis elbow**
Authors, title of the study and source	<u>Pages IH</u> , Hermann H, Conradi E: Magnetic field of chronic degenerative diseases of the musculoskeletal system. Z Physiother 1985;37:21-24
Number of patients	48
Disease	Epicondylitis
Treatment	Sinus, max. 240 G, 50/60 Hz., daily 20 min. 5 days
Improvement	Pain intensity was measured, in the MFT group: Symptom free 25%, better 58,3%, unchanged 12,5%, worse 4,2% In the blind placebo treated group: Symptom free 29,2%, better 12,5%, unchanged 58,3%, worse 0%
Remarks	In the MFT group thus 83.3 % successful vs. 41.7 % in the placebo group. Obviously here lies the importance in spontaneous recovery. With MFT, however, this can be increased by 100 %.

	<u>Tinnitus**</u>
Authors, title of the study and source	<u>Roland NJ</u> , Hughes JB, Daley MB, Cook JA, Jones AS, McCormick MS. Electromagnetic stimulation as a treatment for tinnitus: a pilot study. Clin Otolaryngol. 1993, 18, 278-281
Number of patients	58
Disease	Sensorineural Tinnitus
Treatment	15 min /day, 1 week, on the neck or over the mastoid. Variety of electromagnetic signals from low frequencies.
Improvement	Highly significant improvement of subjective symptoms (45% in the MFT group, 9% in the Placebo group) and significant improvements in audiographer measurements.
Remarks	Chronic tinnitus is a disease very difficult to treat with multiple causes. The reasons were not included in this study. The authors believe that the pilot study shows very good results.

	<u>Leg ulcers, venous Ulcers**</u>, <i>wound healing disorder</i>
Authors, title of the study and source	<u>Stiller MJ</u> , Pak GH, Shupack JL, Thaler S, Kenny C, Jondreau L: A portable pulsed electromagnetic field (PEMF) device to enhance healing of recalcitrant venous ulcers: a double – blind, placebo-controlled clinical trial. Br J Dermatol 1992;127:147-154
Number of patients	31
Disease	Leg ulcers due to venous stasis, which were not curable with standard therapy over > 4 weeks, and showed no tendency to heal itself. Patients with arterial disorders and thrombosis were excluded.
Treatment	3 pcs./ day, bidirectional symmetrical 22 G. 8 weeks
Improvement	In the MFT group the wound area had decreased by 47:7 %; but in the placebo group showed an increase of 42,3 %. In the MFT group 50 % of the patients were cured or remarkably better, while 0 % were cured in the placebo group and 54 % were worse. The MFT group showed a significant decrease in the wound depth and pain loss. No side effects.
Remarks	Multicentre study (8 centre in USA); funded by the National Institute of Health. Stimulation with sine waves induces the differentiation of human connective tissue cells in the skin (fibroblasts) and increases collagen formation and protein synthesis (Lit) Furthermore, there is a new vessel formation (angiogenesis), endothelial cells grow faster (endothelium), and parts of the DNS are increasingly being written off (mRNA transcript), the hormonal regulation is affected, enzyme activity increases, the cell receptor expression increases. (Literature quotation of Science)

	<u>Leg ulcers, venous Ulcers**</u>, <i>wound healing disorder</i>
Authors, title of the study and source	<u>Leran M</u> , Zaffuto S, Bagnacani M, Annovi M, Moratti A, Cadessi R. Effect of low frequency pulsing electromagnetic field on skin ulcers of venous origin in humans: a double-blind study. J. Orthop. Res. 1990, 276-282
Number of patients	44
Disease	Venous ulcers caused by venous insufficiency, post-thrombotic phlebitis, not arterial, no steroids, no systemic diseases
Treatment	3-4 St/Tg, > 90 Tage, Sägezahn, 28 G, 75 Hz.
Improvement	In MFT group 66.6 % were healed, in the placebo group 31 %. Patients were observed up to 1 year. Then in the MFT group were 88.8% healed in the control group 66%. Not a single patient of the MFT group deteriorated during the treatment. In the MFT group at the follow up check during the first year 25% of Ulcers came back, in the placebo group 50%
Remarks	Conclusion: The MFT has a wound healing and preventative against new ulcers effect during and after the therapy

Hip joint pain: refer to hip joint abrasion**

Capsular injuries: refer to inflammation of the tendons and muscle **

Lumbar spine syndrome: refer to back pain, **

Lumbago: refer to back pain**

Muscle cramps: refer to muscle spasms**

Myalgia: refer to musculoskeletal pain**

Polyarthritis: refer to Arthritis**

Polyneuropathy: refer to nerve injury*

Spinal cord injury: refer to nerve injury*

Backache: refer to sacroiliac pain

Shoulder - Arm – Syndrome: refer to inflammation of the tendon and muscle attachments**

Chronic shoulder pain: refer to inflammation of the muscle attachments and tendons**

Tendinitis **: refer to inflammation of the tendons and muscle attachments

Tendon injury**: refer to inflammation of the tendons and muscle attachments

Tension: refer to muscle spasms**

Wound healing: refer to leg ulcer**

topic: Acceptance of scientific research:

Pool R. Electromagnetic fields: The biological evidence **Science** 1990, 249: 1378-81

summary:

Electromagnetic fields exert their effect by the fact that

- the ionic bond changes at the cell membrane
- the biochemical processes changes in the cell

such as RNA Synthesis and protein synthesis (in fibroblasts, osteoblasts, which affects the growth rate)

- the receptor properties change
- the Calcium ion influx increases, but only in dividing cells (cells resting and healthy cells are in this regard stable)
- the parathyroid hormone is inhibited. This hormone promotes bone resorption and inhibits bone formation. The inhibition of this hormone is probably the explanation for the good results of the MFT in orthopaedics and in the treatment and prevention of osteoporosis (postmenopausal as well as through inactivity)

Topic: Safety

Bassett C.A.L. Bioelectromagnetics in the service of medicine, **American Chemical Society**, 1995, 261-275

Capanna R, Donati D, Masetti C, et al: Effect of electromagnetic fields on patients undergoing massive bone transplant following bone tumour resection. Double-blind study. **Clin Orthop** 1994:213-221

McCann J, Dietrich F, Rafferty Ch. The genotoxic potential of electric and magnetic fields: an update. **Mutation Research**, 1998, 411: 45-86

Jacobson-Kram DJ, Tepper J, Kuo P, San RHC, Curry PT, Wagner VO, Putman DL. Evaluation of potential genotoxicity of pulsed electric and electromagnetic fields used for bone growth stimulation **Mutation Research**, 1997, 388: 45-47

Jauchem JR. Electromagnetic field: Is there a danger? **Lancet** 1990, 336:884

Pool R. Electromagnetic fields: the biological evidence **Science** 1990, 249: 1378-81

summary:

All recent concerns about electromagnetic fields in the therapeutically used frequencies and intensities are hereby regarded as void! There could not be any evidence proved in any way that danger or a risk to DNA, protein-, cell-, tissue-, nor animal- or on human level occurred.

Review Basset CAL. Bioelectromagnetics in the service of medicine, **American Chemical Society**, 1995, 261-275: „In 15 years more than 300.000 Fractures were treated, without any side effects or danger. The method of magnetic field therapy does not pose any risk“.

Topic	<u>Gene damage?</u>
Authors, Title of studies and source	<u>McCann J</u> , Dietrich F, Rafferty Ch. The genotoxic potential of electric and magnetic fields: an update. Mutation Research, 1998, 411: 45-86 .
Type of study	Review of over 23 studies from 1993 until now, as reference to a review of the same group over 55 studies prior to 1993, with the topic: the potential risk of gene-damaging through electric and magnetic fields
Questions	Is there a scientific basis for the hypothesis that electric and magnetic fields through gene damage generates cancer?
Result	The 34 studies which say that a gene-damaging effect would be detectable, are not qualitatively in order, or could not be reproduced by other research centres. 12 Studies that were to testify were not repeated by independent studies. These concern the effect of rigid frequency pattern of the electrical supply fields (50-60 Hz, power grid).
Conclusion	This review reinforces the conclusion of the previous review of the same group that the majority part of the studies prove that electrical and magnetic fields have NO gene-injury potential.
Remarks	Up to date, no evidence of carcinogenic effect of magnetic fields has presented itself from the frequencies used with the usual magnetic field therapy devices.

	<u>Treatment with magnetic field by patients with bone tumours: bone transplant after bone tumour resection**</u>
Authors, Title of studies and source	<u>Capanna R</u> , Donati D, Masetti C, et al: Effect of electromagnetic fields on patients undergoing massive bone transplant following bone tumour resection. A double-blind study. Clin Orthop 1994:213-221
Number of patients	47
Disease	Malignant bone tumour was removed, following bone transplant of various kinds.
Treatment	75 Hz, 8 pcs/day, 12 months
Improvements	MFT had no effect when the total number of patients were compared in the groups but in the sub-groups which received no chemotherapy (9 in every group), the healing time in the MFT group was significantly shorter (6,7 months vs. 9,4 months)
Remarks	The authors present the hypothesis that the MFT cannot be effective if the cell growth is suppressed by chemotherapy. The authors consider the MFT as completely risk-free, even when used by cancer patients and as quoted in cell studies and studies on humans with tumours (including brain tumour), prove that MFT causes no tumour growth and no side effects or adverse cases.

Topic	<u>Mutation due to electromagnetic fields?</u>
Authors, Title of studies and source	<u>Pool R</u> : Electromagnetic Fields: The biological evidence. Science 1990, 249: 378-81
Type of study	Scientific statement.
Question	Is there evidence that electromagnetic fields cause mutations?
Result	Many of the data give an indication of the aforementioned risk of electromagnetic fields related field strengths, which are a thousand times stronger than those with which we are normally in contact. Furthermore there is little data that has been confirmed by independent laboratories. On the other hand there are studies to prove that there is NO risk for mutations in cellular DNA, especially when far too low energy was used, there was no possibility of damaging the molecules.
Conclusion	The data, which indicates potential risks, is uncertain, not statistically significant or relevant.
Remark	This publication is an all-clear signal.

Topic	<u>Risk of electromagnetic fields</u>
Authors, Title of study and source	<u>Jauchem JR</u> : Electromagnetic field: Is there a danger? The Lancet 1990, 336: 884
Type of study	report
Question	Is there a link between electromagnetic fields and cancer?
Result	It is very unfortunate that the misinformation continue in the lay press, although there is reliable scientific data. The data is insufficient to suggest a cause between electromagnetic fields and cancer. The media distort the data situation. A link between electromagnetic fields and cancer is very doubtful or not given.
Conclusion	Currently there is no proven danger.
Remarks	Thus a firm stand is taken against the misleading presentation of scientific data in the lay press.

Topic	<u>Potential genotoxicity of electromagnetic fields</u>
Authors, Title of study and source	<u>Jacobson-Kram DJ, Tepper J, Kuo P, San RHC, Curry PT, Wagner VO, Putman DL</u> . Evaluation of potential genotoxicity of pulsed electric and electromagnetic fields used for bone growth stimulation. Mutation Research, 1997, 388: 45-47
Type of study	Study on chromosomes and cells (in vitro)
Question	Have electromagnetic fields of this type used in medical applications – a mutagenic hazard?
Result	A cell damaging, transforming and mutating activity was missing in all experiments of this study.
Conclusion	There is no evidence of a cell damaging, transforming and mutating activity.
Remarks	Outstanding in detail -vitro work.

Topic: electromagnetic fields in the fight against cancer

Capanna R , Donati D, Masetti C, et al: Effect of electromagnetic fields on patients undergoing massive bone transplant following bone tumour resection. Double-blind study. **Clin Orthop** 1994:213-221

Hirata M, Kusuzaki K, Takeshita H, Hashiguchi S, Hirasawa Y, Ashihara T. Drug resistance modification using pulsing electromagnetic field stimulation for multidrug resistant mouse osteosarcoma cell line. **Anticancer Research** 2001, 21(1A): 317-20

Liang Y, Hanna Ch, Chang BK, Schoenlein PC. Enhanced Potency of Daunorubicin against multidrug resistant subline KB-ChR8-5-11 by pulsed magnetic field **Anticancer Research** 1997, 17: 2083-2088

Kiselev AV, Grushina TI. The use of artificial magnetic field for rehabilitation of children with malignant tumours **Vopr. Onkol.** 2000; 46(4); 469-72

Summary:

Therapeutic application of electromagnetic fields in the fight against cancer is possible.

	<u>Bone transplant after bone tumour resection**</u>
Authors, Title of study and source	<u>Capanna R</u> , Donati D, Masetti C, et al: Effect of electromagnetic fields on patients undergoing massive bone transplant following bone tumour resection. A double-blind study. Clin Orthop 1994:213-221
Number of patient	47
Disease	Removal of malignant lesions of bones with subsequent bone transplant of various kinds
Treatment	75 Hz, 8 pcs/day, 12 months
Improvement	MFT had no effect when the total number of patients were compared in the groups but in the sub-groups which received no chemotherapy (9 in every group), the healing time in the MFT group was significantly shorter (6,7 months vs. 9,4 months))
Remarks	The authors consider the MFT to be very useful in the treatment of cancer patients who need bone transplant. The authors present the hypothesis that the MFT cannot be effective if the cell growth is suppressed by chemotherapy. The authors consider the MFT as completely risk-free, and as quoted in cell studies and studies on humans with tumours (including brain tumour), prove that MFT causes no tumour growth and no side effects or adverse cases.

Topic	<u>Electromagnetic fields as a local treatment for chemotherapy resistant bone cancer cells</u>
Authors title of study and source	<u>Hirata M</u> , Kusuzaki H, Hashiguchi S, Hirsawa Y, Ashihara T. Drug resistance modification using pulsing electromagnetic field stimulation for multidrug resistant mouse osteosarcoma cell line. Anticancer Research 2001, 21(1A): 317-20
Type of study	Genetic technologic work on a bone cancer cell-line of mice
Question	Is there a way to break through the resistance of cancer cells to chemotherapeutic agents (multidrug resistance)?
Result	Electromagnetic fields can break the resistance of cancer cells-lines.
Conclusion	Electromagnetic fields can be used as a local treatment for “multidrug resistance”
Remark	The therapeutic application of electromagnetic fields in the fight against cancer is possible.

Topic	<u>Electromagnetic fields as a local treatment for Chemotherapy-resistant bone cancer cells</u>
Authors, Title of the study and source	<u>Liang Y</u> , Hanna Ch, Chang BK, Schoenlein PC. Enhanced Potency of Daunorubicin against multidrug resistant subline KB-ChR8-5-11 by pulsed magnetic field. Anticancer Research 1997, 17: 2083-2088
Type of study	Genetic technologic work on bone cancer cell-line of mice, as well as on living mice with tumours.
Question	Can electromagnetic fields break the resistance of cancer cells to chemotherapeutic agents (Multidrug resistance)?
Result	The cells were sensitive again to the chemotherapy. The living mice showed a delayed growth of tumours during the treatment with electromagnetic fields.
Conclusion	Electromagnetic fields can break the resistance of cancer cells to chemotherapeutic agents (Multidrug resistance). Tumour growth is retarded.
Remarks	Therapeutic application of electromagnetic fields in the fight against cancer is possible.

Topic	<u>Electromagnetic fields in cancer therapy</u>
Authors, Title of the study and source	<u>Kiselev AV</u> , Grushina TI. Use of artificial magnetic field for rehabilitation of children with malignant tumours. Vopr. Onkol. 2000; 46(4); 469-72
Type of study	Clinical observational study
Question	Electromagnetic fields have a positive effect on wound healing. Does it also apply for cancer patients?
Result	Electromagnetic fields speed up the healing of 400 cancer patients to 3 – 3,5 times, and it was 2 – 3 times more effective than standard therapy. Clinically proven intestinal closures could be cured in 18 children with lymphosarcoma.
Conclusion	Electromagnetic fields heal wounds faster and better on cancer patients than the standard therapy.
Remark	New therapeutic approach for electromagnetic fields in the control of complications of chemotherapy