



NASA's study on PEMF:

FDA Clearance:

- 1979 for non-union fractures
- 1987 for post-operative pain and edema
- 2008 for severe depression in patients who did not respond to drug therapies

Click [here](#) for the full study called PHYSIOLOGICAL AND MOLECULAR GENETIC EFFECTS OF TIME-VARYING ELECTROMAGNETIC FIELDS ON HUMAN NEURONAL CELLS

Thomas J. Goodwin, Ph.D. Lyndon B. Johnson Space Center



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ALZHEIMER'S DISEASE

Impairments in visual memory and visuoconstructive functions commonly occur in patients with Alzheimer's disease (AD). It has been reported that external application of electromagnetic fields (EMF) of extremely low intensity (in the picotesla range) and of low frequency (in the range of 5Hz-8Hz) improved visual memory and visuoceptive functions in patients with Parkinson's disease. The report demonstrates, for the first time, that specific cognitive symptoms of AD are improved by treatment with EMF of a specific intensity and frequency. The rapid improvement in cognitive functions in response to EMF suggests that some of the mental deficits of AD are reversible being caused by a functional (i.e., synaptic transmission) rather than a structural (i.e., neuritic plaques) disruption of neuronal communication in the central nervous system.

– *International Journal of Neuroscience* [PMID: 7960477](#)

Repetitive transcranial magnetic stimulation applied to the dlPFC improves naming performance also in the advanced stages of AD. Moreover, in the severe group the effect is not specific for action naming, as in the case of the mild AD group. These findings suggest that rTMS can affect the intrinsic ability of the brain to restore or compensate for damaged function and may represent a useful new tool for cognitive rehabilitation. – *European Journal of Neurology* [PMID: 19049544](#)

AMYOTROPHIC LATERAL SCLEROSIS (LOU GEHRIG'S DISEASE)

A study of three patients with Amyotrophic Lateral Sclerosis were treated with a pulsed magnetic field. Given three times a week for approximately 75 sessions to achieve maximum benefits, all three experienced beneficial effects.

A. Bellosi & R. Berget, "Pulsed Magnetic Fields: A Glimmer of Hope for Patients Suffering from Amyotrophic Lateral Sclerosis," Second World Congress for Electricity and Magnetism in Biology

and Medicine,
8-13 June 1997, Bologna, Italy.

GRADE 1 & 2 ANKLE SPRAINS / EDEMA

Acutely sprained ankles represent a frequent and common injury among active duty troops in training, and are a significant source of morbidity with respect to days lost to training. In a randomized, prospective, double blind study of 50 grade I and II (no gross instability) sprained ankles, a statistically significant decrease in edema was noted following one treatment with pulsed electro magnetic field (PEMF) therapy. The application of this modality in acutely sprained ankles could result in significant decreases in time lost to military training. – *Military Medicine* [PMID: 8441490](#)

ARTHRITIS

A total of 33 patients were screened, and 28 patients, aged between 60 and 83 and affected by bilateral knee osteoarthritis, were enrolled in this study. They received PEMF therapy on the right leg for a total of three 30-minute sessions per week for a period of 6 weeks, while the left leg did not receive any treatment and served as control. An intravenous drip containing ketoprofen, sodium clodronate, glucosamine sulfate, calcitonin, and ascorbic acid, for a total volume of 500 mL, was administered during PEMF therapy. At baseline and 3 months post-PEMF therapy, Visual Analog Scale (VAS) was used to assess knee pain and Western Ontario McMaster Universities Osteoarthritis Index (WOMAC) was used to measure knee pain, stiffness and physical function.

RESULTS:

Changes in VAS and WOMAC scores were calculated for both knees as baseline minus post-treatment. A two sample Student's t-test, comparing change in knee-related VAS pain for PEMF-treated leg (49.8 ± 2.03) vs control leg (11 ± 1.1), showed a significant difference in favor of PEMF therapy ($P < 0.001$). A two sample Student's t-test comparing change in knee-related WOMAC pain, stiffness, and physical function for PEMF-treated leg (8.5 ± 0.4 , 3.5 ± 0.2 , 38.5 ± 2.08 , respectively) vs control leg (2.6 ± 0.2 ; 1.6 ± 0.1 ; 4.5 ± 0.5 respectively), also showed a significant difference in favor of PEMF therapy ($P < 0.001$). No adverse reactions to therapy were observed.

CONCLUSION:

The present study shows that PEMF therapy improves pain, stiffness and physical function in elderly patients affected by knee osteoarthritis. [PMID: 24106421](#)

Low frequency pulsed electromagnetic field (PEMF) can provide noninvasive, safe and easy to apply method to treat pain,

inflammation and dysfunctions associated with rheumatoid arthritis (RA) and osteoarthritis (OA) and PEMF has a long term record of safety. This review focusses on the therapeutic application of PEMF in the treatment of these forms of arthritis. The analysis of various studies (animal models of arthritis, cell culture systems and clinical trials) reporting the use of PEMF for arthritis cure has conclusively shown that PEMF not only alleviates the pain in the arthritis condition but it also affords chondroprotection, exerts antiinflammatory action and helps in bone remodeling and this could be developed as a viable alternative for arthritis therapy. [PMID: 20329696](#)

BACK PAIN

Back pain and the whiplash syndrome are very common conditions involving tremendous costs and extensive medical effort. A quick and effective reduction of symptoms, especially pain, is required. Magnetic fields appear to have a considerable and statistically significant potential for reducing pain in cases of lumbar radiculopathy and the whiplash syndrome. – Neuro Rehabilitation [PMID: 12016348](#)

BACK PAIN – LOW BACK

This randomized, double-blind, placebo-controlled clinical trial studied the effectiveness of pulsed electromagnetic therapy (PEMT) in patients with chronic lower back pain. PEMT produced significant pain reduction throughout the observation period compared with baseline values. The percentage change in the NRS score from baseline was significantly greater in the PEMT group than the placebo group at all three time-points measured. The mean revised Oswestry disability percentage after 4 weeks was significantly improved from the baseline value in the PEMT group, whereas there were no significant differences in the placebo group. In conclusion, PEMT reduced pain and disability and appears to be a potentially useful therapeutic tool for the conservative management of chronic lower back pain. – *Journal of International Research* [PMID: 16749411](#)

We evaluate the efficacy and safety of therapeutic electromagnetic fields (TEMF) on chronic low back pain. Secondary objectives included the investigation of the effects of TEMF on psychometric measures. Both groups improved over time. Although groups were similar during the treatment period, treated subjects (TEMF of 15 mT) improved significantly over sham treatment during the 2-week follow-up period (20.5% reduction in pain); There were no reported serious adverse events. This study demonstrates that TEMF may be an effective

and safe modality for the treatment of chronic low back pain disorders. – *Pain Practice* [PMID: 17714104](#)

BONE DENSITY

To determine the effect of a 72 Hz pulsating electromagnetic field (PEMF) on bone density of the radii of osteoporosis-prone women, the nondominant forearms of 20 subjects were exposed to PEMF 10 h daily for a period of 12 weeks. The data suggest that properly applied PEMFs, if scaled for whole-body use, may have clinical application in the prevention and treatment of osteoporosis.

– *The Journal of Bone and Mineral Research* [PMID: 2195843](#)

BONE FRACTURES

A group of 83 adults with ununited fractures were examined for the effects of bone grafting and pulsed electromagnetic fields for this study. Results showed a successful healing rate of 87 percent in the original 38 patients treated with bone grafts and PEMF for ununited fractures with wide gaps, malalignment, and synovial pseudarthrosis. Of the 45 patients that were not successfully treated with PEMF and had bone grafting, when re-treated with pulsing electromagnetic fields, achieved a 93 percent success rate. (I hope you can comprehend this – there was no union, meaning the bone did not heal until they used pulsed magnetic field therapy) [PMID: 6752151](#)

BPH (ENLARGED PROSTATE)

Ten patients with BPH, aging 68-78 years old (y.o), were treated for 2 weeks with a very short wave duration, pulsed electromagnetic field at radiofrequencies generated by an ion magnetic inductor, for 30 min daily, 5 consecutive days per week.

There was a significant improvement in clinical symptoms. Follow-up of the patients of this group for one year revealed that results obtained by EMFs treatment are still remaining. [PMID: 21537858](#)

PEMF was performed on 20 dogs affected by BPH. 3 weeks of PEMF produced a significant reduction in prostatic volume (average 57%) without any interference with semen quality, testosterone levels or libido. The efficacy of PEMF on BPH in dogs, with no side effects, suggests the suitability of this treatment in humans and supports the hypothesis that impairment of blood supply to the lower urinary tract may be a causative factor in the development of BPH. [PMCID: 4145661](#)

BRONCHITIS

Results of this double-blind, placebo-controlled study indicated that both low-frequency electromagnetic field treatment and treatment with pulsed electromagnetic fields proved effective in patients suffering from chronic bronchitis when coupled with standard drug therapies. Magnetic field treatment consisted of a total of 15 15-20-minute daily exposures.

V.M. Iurlov, et al., "The Efficacy of the Use of Low-Frequency Electromagnetic Fields in Chronic Bronchitis," Voen Med Zh, 3, 1989, . 35-36.

CANCER – BLADDER

The study deals with immune status of patients operated for bladder cancer and exposed postoperatively to alternating magnetic field (MF). MF application was followed by higher T- and B-lymphocyte and CD4+, CD16+ cell levels as well as enhanced T-cell activity; no postoperative complications were registered and tumor relapse rates were relatively low. The effect was likely to be due to antistressor influence of MF. The procedure may substitute drug therapy for immunocorrection and to avoid recurrence of bladder cancer. – *Volpr Onkol* [PMID: 11544830](#)

CANCER – BREAST TUMORS

The study was concerned with effect of alternating magnetic field (AMF) on immunobiological characteristics of lymphocytes from patients with locally-advanced breast tumors. Patients received infusions of treated autoblood and changes in their immunological status were followed up. Stimulation of T-, B- and NK- cells was observed. Immuno-regulating effect was apparent when autoblood was treated with 50 H/25 mT1 and 100 H/50 mT1. – *Volpr Onkol* [PMID: 15088521](#)

CANCER – CELLS

PEMF promotes the growth of undifferentiated cells but progressively suppresses the growth of more differentiated cells, i.e., PEMF controls cell growth depending on the degree of cell differentiation. This study also shows the potentiality of PEMF as an adjunctive treatment method for malignant tumors. – *Bioelectromagnetics* [PMID: 10653622](#)

No adverse side-effects were reported in an investigation of the antitumor effect of turbulent magnetic field (TMF) carried out as a component of preoperative chemoradiotherapy for breast cancer at the Center's Clinic. The study group included 114 patients with

locally advanced tumors(T3, N1-N3, M0). According to the clinical, roentgenological and histological evidence on the end-results, the procedure was highly effective. Also, it was followed by shorter and less extensive postoperative lymphorrhea. – *Volpr Onko*

CANCER

Results of this study found that prolonged exposure to a 7-tesla uniform static magnetic field for a period of 64 hours inhibited growth of three human tumor cell lines in vitro.

R.R. Raylman, et al., "Exposure to Strong Static Magnetic Field Slows the Growth of Human Cancer Cells in Vitro," Bioelectromagnetics, 17(5), 1996, . 358-363.

This study examined the effects of a rotational magnetic field on a group of 51 breast cancer patients. Results showed a significant positive response in 27 of them.

N.G. Bakhmutskii, et al., "The Assessment of the Efficacy of the Effect of a Rotational Magnetic Field on the Course of the Tumor Process in Patients with Generalized Breast Cancer," Sov Med, (7), 1991, . 25-27.

Results of this study indicated that exposure to a rotational magnetic field inhibited Walker's carcinoma tumor growth as much as 90 percent in some cases.

N.G. Bakhmutskii, et al., "The Growth Dynamics of Walker Carcinosarcoma During Exposure to a Magnetic Eddy Field," Vopr Onkol, 37(6), 1991, . 705-708.

Results of this study indicated that pulsed magnetic field stimulation increased the incorporation of antitumor agents into cells, and thus increased antitumor activity shifting the cell cycle to a proliferative from a nonproliferative phase.

Y. Omote, "An Experimental Attempt to Potentiate Therapeutic Effects of Combined Use of Pulsing Magnetic Fields and Antitumor Agents," Nippon Geka Gakkai Zasshi, 89(8), August 1988, .. 1155-1166.

Results of this study found that 20-30 sessions of magnetotherapy administered preoperatively exhibited antitumor effects in patients suffering from lung cancer.

L.S. Ogorodnikova, et al., "Morphological Criteria of Lung Cancer Regression Under the Effect of Magnetotherapy," Vopr Onkol, 26(1), 1980, . 28-34.

Results of this study proved that the combination of weak pulsed

electromagnetic fields with antioxidant supplementation is beneficial in the treatment of patients suffering from tongue cancer, improving speech, pain control, and tolerance to chemotherapy.

U. Randoll & R.M. Pangan, "The Role of Complex Biophysical-Chemical Therapies for Cancer," Bioelectrochem Bioenerg, 27(3), 1992, . 341-346.

Results of this controlled study indicated that treatment with a constant magnetic field significantly improved long-term (3-year) survival time in patients undergoing radiation therapy for cancer of the throat. Constant magnetic field therapy consisted of the application of 300 mT for 30 minutes to tumor and metastasizing regions immediately prior to each irradiation.

V.G. Andreev, et al., "Radiomodifying Effect of a Constant Magnetic Field in Radiation Therapy of Patients with Cancer of the Throat," Fizicheskaja Meditzina, 4(1-2), 1994,. 92.

Results of this Russian study indicated that the use of whole body eddy magnetic fields, coupled with more conventional cancer therapies (including magnetotherapy) is effective in the treatment of patients suffering from a variety of different malignancies.

V. Smirnova, "Anti-Tumorigenic Action of an Eddy Magnetic Field," Vrach, 2, 1994, . 25-26

This article reports on the case of a 48-year-old-woman with breast cancer who was treated successfully with magnetotherapy. Infiltration showed a marked decrease following 30 whole body exposures to an eddy magnetic field for 60 minutes. One metastatic node disappeared while the size of others was reduced following 60 such exposures. A total regression of tumor and metastases was seen following the completion of a course of 110 exposures.

N.G. Bakhmutskii, et al., "A Case of Successful Treatment of a Patient with Breast Cancer Using a Rotating Electromagnetic Field," Soviet Medicine, 8, 1991, . 86-87.

This study examined the effects of whole body magnetic fields (16.5-35 G, 50- 165 Hz) on patients suffering from different forms of cancer. Treatment consisted of 15 cycles, each 1-20 minutes in duration, and was coupled with more traditional cancer therapies. Results showed that the magnetotherapy had overall beneficial effects, particularly with respect to improved immune status and postoperative recovery.

V.A. Lubennikov, et al., "First Experience in Using a Whole-Body Magnetic Field Exposure in Treating Cancer Patients," Vopr Onkol, 41(2), 1995, .140-141.

CARPAL TUNNEL SYNDROME

PEMF exposure (dynamic magnetic fields) in refractory carpal tunnel syndrome provides statistically significant short and long-term pain reduction and mild improvement in objective neuronal functions. Neuromodulation appears to influence nociceptive-C and large A-fiber functions, probably through ion/ligand binding. – *Pain Medicine*

<https://www.ncbi.nlm.nih.gov/pubmed/?term=18777606>

CARTILAGE

Severe joint inflammation following trauma, arthroscopic surgery or infection can damage articular cartilage, thus every effort should be made to protect cartilage from the catabolic effects of pro-inflammatory cytokines and stimulate cartilage anabolic activities. Previous pre-clinical studies have shown that pulsed electromagnetic fields (PEMFs) can protect articular cartilage from the catabolic effects of pro-inflammatory cytokines, and prevent its degeneration. The percentage of patients who used NSAIDs was 26% in the active group and 75% in the control group. At 3 years follow-up, the number of patients who completely recovered was higher in the active group compared to the control group. Treatment with I-ONE aided patient recovery after arthroscopic surgery, reduced the use of NSAIDs, and also had a positive long-term effect.

– *Knee Surgery, Sports Traumatology, Arthroscopy*

CHRONIC PAIN

Specific pulsed electromagnetic fields (PEMFs) have been shown to induce analgesia (antinociception) in healthy human volunteers. These findings provide some initial support for the use of PEMF exposure in reducing pain in chronic pain populations and warrants continued investigation into the use of PEMF exposure for short-term pain relief. – *Pain Research & Management*

DENTAL PAIN

Two hours of exposure to a weak, oscillating magnetic fields induced a significant decrease in three parameters (dental sensory and cutaneous pain and tolerance thresholds), whereas the other two parameters showed a similar tendency. When the same subjects were exposed to a sham treatment, only marginal, nonsignificant variations in all parameters were observed. These

results represent the first piece of evidence that weak alterations of the magnetic field may induce hyperalgesia in humans. – Bioelectromagnetics

DEPRESSION

This review article examined the literature concerning the use of transcranial magnetic stimulation in the treatment of depression. Results showed the high-frequency, repetitive transcranial magnetic stimulation treatment to be an effective, side-effect free therapy for depression that may hold promise for treating related psychiatric disorders as well.

M.T. Kirkcaldie, et al., "Transcranial Magnetic Stimulation as Therapy for Depression and Other Disorders," Aust N Z J Psychiatry, 31(2), April 1997, . 264- 272.

Noting that there is good reason to believe the pineal gland is a magnetosensitive system and that application of magnetic fields in experimental animals has a similar effect to that of acute exposure to light with respect to melatonin secretion, the authors propose that magnetic treatment could be a beneficial new therapy for winter depression in humans.

R. Sandyk, et al., "Magnetic Fields and Seasonality of Affective Illness: Implications for Therapy," International Journal of Neurosci, 58(3-4), June 1991, . 261-267.

This review article notes that transcranial magnetic stimulation has been shown to elicit antidepressant effects, electrically stimulating deep regions of the brain.

C. Haag, et al., "Transcranial Magnetic Stimulation. A Diagnostic Means from Neurology as Therapy in Psychiatry?" Nervenarzt, 68(3), March 1997, . 274-278.

In this theoretical paper, the author argues that deep, low-rate transcranial magnetic stimulation can produce therapeutic effects equivalent to those of electroconvulsive therapy but without the dangerous side effects.

T. Zyss, "Will Electroconvulsive Therapy Induce Seizures: Magnetic Brain Stimulation as Hypothesis of a New Psychiatric Therapy," Psychiatr Pol, 26(6), November-December 1992, . 531-541.

Results of this study led researchers to conclude that patients suffering from major depression experienced a significant reduction of depressive symptoms following treatment with transcranial magnetic stimulation coupled with standard medication relative to patients taking the medicine. This was true

after just three TMS treatments.

Conca, et al., "Transcranial Magnetic Stimulation: A Novel Antidepressive Strategy?" Neuropsychobiology, 34(4), 1996, . 204-207.

DIABETES

This study involving 72 diabetics with purulent wounds found that magnetic fields aided healing significantly.

R.A. Kuliev & R.F. Babaev, "A Magnetic Field in the Combined Treatment of Suppurative Wounds in Diabetes Mellitus," Vestn Khir Im I I Grek, 148(1), January 1992, . 33-36.

DIABETIC NEUROPATHY / ANGIOPATHY

Significant improvement of symptoms, and of all registered parameters of peripheral circulation was established after the therapy. High-frequency pulsating electromagnetic field is recommended for the treatment of diabetic angiopathy. In patients with neuropathic changes it can be used as an introduction procedure. – *Srpski arhiv za celokupno lekarstvo*

<https://www.ncbi.nlm.nih.gov/pubmed/?term=7725151>

This study demonstrates that pulsed electromagnetic fields are able to accelerate wound healing under diabetic and normal conditions by up-regulation of FGF-2-mediated angiogenesis. They also prevented tissue necrosis in response to a standardized ischemic insult, suggesting that noninvasive angiogenic stimulation by pulsed electromagnetic fields may be useful to prevent ulcer formation, necrosis, and amputation in diabetic patients. – *Plastic and Reconstructive Surgery* [PMID: 7725151](https://pubmed.ncbi.nlm.nih.gov/7725151/)

DUCHENNE-ERB DISEASE

This study examined the effects of electromagnetic fields in the treatment of 5- year-old children suffering from Duchenne-Erb disease. Children were exposed to either UHF or DMW therapy for 8-12 minutes per day on alternating days over a period of approximately 10 days. Following the electromagnetic fields course, children received mud applications on the collar area and injured extremity. Results showed that treatment decreased contractures in shoulder and elbow joints, increased mobility and muscle strength, and improved general function of the arm.

A.D. Burigina, et al., "Electromagnetic Waves in Complex Therapy of Children with Birth Trauma: Effects of Ultra-High-Frequency Electric Fields on Central Hemodynamics and the Shoulder

Plexus,” Vopr Kurortol Fizioter Lech Fiz Kult, (4), 1992, 35-38.

ENDOMETRITIS

Results of this study found that the administration of constant magnetic field in combination with other treatment modalities led to significant beneficial effects in patients suffering from acute endometritis following abortion.

V.M. Strugatskii, et al., “A Permanent Magnetic Field in the Combined Treatment of Acute Endometritis After an Artificial Abortion,” Vopr Kurortol Fizioter Lech Fiz Kult, (6), November-December 1996, . 21-24.

FIBROMYALGIA

Exposure to a specific pulsed electromagnetic field (PEMF) has been shown to produce analgesic (antinociceptive) effects in many organisms. In a randomized, double-blind, sham-controlled clinical trial, patients with either chronic generalized pain from fibromyalgia (FM) or chronic localized musculoskeletal or inflammatory pain were exposed to a PEMF (400 microT) through a portable device fitted to their head during twice-daily 40 min treatments over seven days. PEMF may be a novel, safe and effective therapeutic tool for use in at least certain subsets of patients with chronic, nonmalignant pain. – *Pain Research & Management*

GASTRODUODENITIS (inflammation of stomach & duodenum)

Results of this study indicated that treatment with decimeter-band electromagnetic fields improved motor function of the stomach and reduced dyspepsia and pain in children suffering from chronic gastroduodenitis. Treatment applied to the gastroduodenal region, and consisted of 6-12 minute exposures every other day for a total of 8-12 exposures.

L.M. Petrukhina, et al., “Effect of a Decimeter Wave Electromagnetic Fields on the Motor Function of the Stomach in Children with Strong Gastroduodenitis,” Vopr Kurortol Fizioter Lech Fiz Kult, (1), 1987, . 54-56.

GENERAL RESULTS

This study indicated that the optimal frequency of pulsed magnetic fields ranges between 10.0 and 25.0 Hz in the treatment of chronic inflammatory conditions of the locomotor apparatus, ischemia of the blood vessels of the lower extremities, dyspeptic

syndrome, lactation mastitis, and other diseases. Treatment proved best when the therapeutic cycle was repeated after a 2-3 month period.

L. Navratil, et al., "Possible Therapeutic Applications of Pulsed Magnetic Fields," Cas Lek Cesk, 132(19), October 11, 1993, . 590-594.

This article reviews the use of magnetotherapy in Czechoslovakia. Noting that this modality has been used for more than a decade, the author states that magnetotherapy has been shown to be effective in treating rheumatic diseases, sinusitis, enuresis, and ischemic disorders of the lower extremities. Positive findings have also been shown with respect to multiple sclerosis and degenerative diseases of the retina.

J. Jerabek, "Pulsed Magnetotherapy in Czechoslovakia—A Review," Rev Environ Health, 10(2), April-June 1994, . 127-134.

This study examined the effects of electromagnetic fields administered over a period of 10 days on 354 patients suffering from various orthopedic conditions. Results showed the effects to be positive, with the greatest benefit experienced among patients with acute lesions.

G. Annaratone, et al., "Magnetotherapy in Clinical and Ambulatory Practice," Minerva Med, 74(14-15), April 7, 1983, . 823-833.

Noting that beneficial effects of low-energy, time-varying magnetic fields have been shown since the early 1970s, this review article cites studies pointing to its success in the treatment of a wide range of conditions. The best results for this modality obtained in the area of bone healing.

C.A. Bassett, "Fundamental and Practical Aspects of Therapeutic Uses of Pulsed Electromagnetic Fields (PEMFs)," Crit Rev Biomed Eng, 17(5), 1989, . 451-529.

This review article claims that over a quarter of a million patients worldwide with chronically ununited fractures have experienced beneficial results from treatment with pulsed electromagnetic fields. In addition, the author cites studies pointing to the treatment's efficacy with respect to other conditions such as nerve regeneration; wound healing, graft behavior, diabetes, heart attack, and stroke.

C.A. Bassett, "Beneficial Effects of Electromagnetic Fields," Journal of Cell Biochem, 51(4), April 1993, p. 387-393.

This review article notes that low-intensity millimeter waves have been used for treating a wide variety of medical conditions in the former Soviet Union since 1977, with more than a million patients

treated and more than a thousand treatment centers in existence. This therapy has been approved for widespread use by the Russian Ministry of Health, and over 300 scientific publications have described its effects. A typical course of treatment involves 10-15 daily exposures ranging from 15 to 60 minutes each.

A.G. Pakhomov, "Millimeter Wave Medicine in Russia: A Review of Literature," Infrared Lasers and Millimeter Waves Workshop: The Links Between Microwaves and Laser Optics, January 21-22, 1997, Brooks Air Force Base, Texas.

This study concluded that the use of millimeter wave (MW) therapy was effective in the treatment of both children and adults suffering from a variety of orthopedic diseases, including osteochondrosis, arthrosis, infantile cerebral paralysis, Perthes' disease, and inborn femur dislocation. MW therapy made use of the G4- 142 apparatus (55-65 GHz). Exposure was for 15-30 minutes in children or 30-60 minutes in adults over a period of 10-12 total exposures.

S.D. Schvchenko, et al., "Experience with Treating Some Orthopedic Diseases with Millimeter Range Radiation of Nonthermal Intensity," Millimeter Waves in Medicine and Biology. Digest of Papers of the 11th Russian Symposium with International Participation, April 21-24, 1997, Zvenigorod, Moscow Region, Russia, p. 33-35. 139. A.M.

This research examined the effects of low-frequency pulsed electromagnetic fields on patients suffering from a wide range of disorders, including musculoskeletal disorders, neurological disorders, circulatory diseases, traumatic disorders, gastroenterological problems, and stress-related morbidity. Treatment produced waveforms with peak amplitudes up to 30 G. Results, based on the patients' own subjective ratings, indicated the treatment to be beneficial across most conditions, with the strongest effects seen in those suffering from musculoskeletal and traumatic disorders.

Begue-Simon & R.A. Drolet, "Clinical Assessment of the Rhumart System based on the Use of Pulsed Electromagnetic Fields with Low Frequency," International Journal of Rehabil Research, 16(4), 1993, p. 323-327.

This review article summarizes findings presented at the Third Workshop on the use of low-intensity millimeter waves in medicine, held in Zvenigorod, Moscow Region, Russia. Such findings pointed to the efficacy of MW therapy with respect to alcoholism and its associated symptoms, gastric and duodenal ulcers, psoriasis, chronic furunculosis, and cardiovascular diseases.

Y.L. Arzumanov, "An Overview of the Third Workshop 'Use of Millimeter Waves in Medicine,'" *Millimetrovie Volni v Biologii i Meditsine*, (3), 1994, p. 104-107.

This study examined the effects of magnetotherapy on patients suffering from a variety of eye and brain vascular disorders. Results showed overall general improvements in 95 percent of patients with eye diseases.

N. Gilinskaya & L.V. Zobina, "Magnetic Field Application for the Treatment of Vascular Diseases of the Brain and Eyes," in Y.A. Kholodov & N.N. Lebedeva (eds.), *Problems of Electromagnetic Neurobiology*, Moscow, Nauka, 1988, p. 94-98.

This review article notes that low-frequency electromagnetic therapy has been used for a variety of purposes. Those specifically identified by the author include cell growth promotion, pain reduction, improved blood circulation, bone repair, increased wound healing, sedative effects, enhanced sleep, and arthritic relief.

R.A. Drolet, "Rhumart Therapy: A Non-invasive Cell Regeneration Ion and Anti-Inflammatory Therapy Using LF-EM Fields," *Bioelectromagnetics Society, 4th Annual Meeting, 28 June-2 July 1982, Los Angeles, CA*, p. 45.

This review article notes that treatment used to deliver low-frequency magnetic fields, has been shown to improve general hemodynamics and microcirculation in addition to exhibiting anti-inflammatory, sedative, and analgesic effects in Olympic-level Russian athletes.

A. Zaslavskii, et al., "A Low-frequency Impulse Apparatus for Physical Therapy 'Infita'," *Med Tehk*, 5, 1994, p. 39-41.

This review article cites studies pointing to the efficacy of low-frequency magnetic fields in the treatment of a wide variety of conditions, including burns, arthritis, fractures, arterial aneurysms, PMS, phantom pain, tuberculosis, ischemic heart disease, hypertension, bronchial asthma, and ulcerated varicose veins, among others.

V.M. Bogoliubov & L.A. Skurikhina, "Therapeutic Application of Constant and Low-Frequency Magnetic Fields," *Vopr Kurortol Fizioter Lech Fiz Kult*, (2), 1979, p. 65-72.

This study examined the effects of extremely-low-frequency magnetic fields in the treatment of a group of 650 patients suffering from a host of various diseases. Treatment consisted 15-25 minute daily exposures 5 days per week over a total of 20-25 days. Most patients experienced improvements after 2-3

exposures. Marked improvements were seen with respect to analgesic, anti-inflammatory, anti-tumor, and immune-enhancing effects.

V.I. Kovalchuk, et al., "Use of Extremely-Low-Frequency Magnetic Fields in Clinical Practice," Fizicheskaja Meditsina, 4(1-2), 1994, p. 87

This article reports on the efficacy of Russian electromagnetic stimulation. The authors state that data from 508 patients suffering from various ailments who were treated with the device indicate it to be anywhere from 75 to 100 percent effective. Examples of conditions in which the device was used include stubborn fractures, post-traumatic contractures, crush syndrome, and Perthes' disease.

S.A. Schastnyi, et al., "A Contact-Free, Biologically Adequate Electromagnetic Stimulation of Repair Regeneration of Osseous, Cartilaginous, and Muscular Tissues in Children," Vestn Ross Akad Med Nauk, (3), 1994, p. 38-42.

This review article on the use of pulsed magnetotherapy in Czechoslovakia points to its efficacy across a variety of conditions, including joint problems, enuresis, multiple sclerosis, diabetes, and carpal tunnel syndrome.

J. Jerabek, "Pulsed Magnetotherapy in Czechoslovakia: A Review," First World Congress for Electricity and Magnetism in Biology and Medicine, 14-19 June 1992, Lake Buena Vista, FL, p. 81.

GLAUCOMA

In this study, patients with primary open-angle glaucoma with compensated intraocular pressure were administered magnetotherapy using an ATOS device with 33-mT magnetic field induction. The procedure was administered to a patient in a sitting posture with a magnetic inductor held before the eye. Sessions lasted 10 minutes and each course included 10 sessions. Following 4-5 months of therapy, results showed improved vision acuity 0.16 diopters, on an average of 29 out of 30 eyes with vision acuity below 1.0.

Bisvas, et al., "Possibilities of Magnetotherapy in Stabilization of Visual Function in Patients with Glaucoma," Vestn Oftalmol, 112(1), January-March 1996, p. 6-8.

HAIR LOSS

This double-blind, placebo-controlled study examined the effects of pulsed electromagnetic fields on hair loss in men suffering from

male pattern baldness. PEMF exposures were administered to the head for 12 minutes and were given weekly or twice weekly over a period of 36 weeks. Results found the PEMF treatment both prevented hair loss and promoted regrowth without side effects.

W.S. Maddin, et al., "The Biological Effects of a Pulsed Electrostatic with Specific Reference to Hair: Electrotrichogenesis," International Journal of Dermatology, 29(6), 1990, p. 446-450.

HEADACHE

Results of this double-blind, placebo-controlled study demonstrated that the administration of a pulsed magnetic field for less than one hour to headache patients produced significant beneficial effects, as shown subjective patient reports, as well as EEG activity.

O. Grunner, et al., "Cerebral Use of a Pulsating Magnetic Field in Neuropsychiatry Patients with Long-term Headache," EEG EMG Z Elektroenzephalogr Verwandte Geb, 16(4), December 1985, p. 227-230

This article reports on the case of an acute migraine patient who was successfully treated with external magnetic fields.

R. Sandyk, "The Influence of the Pineal Gland on Migraine and Cluster Headaches and Effects of Treatment with picoTesla Magnetic Fields," International Journal of Neurosci, 67(1-4), November-December 1992, p. 145-171.

This article examined the effects of millimeter wave therapy in the treatment of 107 patients suffering from headaches of varying causes. Exposure lasted up to 60 minutes per day over a course of 10 days. All patients experienced positive results following 3-5 exposures. After one year, 48 percent of patients remained free of headaches, with a significant decrease in another 41 percent.

B.M. Popov & T.A. Al'shanskaya, "Use of Traditional and Non-traditional Methods in the Treatment of Headache," Millimeter Waves in Medicine and Biology. Digest of Papers of the 11th Russian Symposium with International Participation, April 21-24, 1997, Zvenigorod, Moscow Region, Russia, p. 68-71.

This study examined the effects of pulsed electromagnetic fields (20 minutes per day for 15 days) in the treatment of patients suffering from chronic headaches. Results indicated the treatment to be most effective in patients suffering from tension headaches, with 88 percent of such patients reporting positive results. Beneficial results were also experienced patients suffering from

migraines (60 percent), cervical migraines (68 percent), and psychogenic headaches (60 percent).

A. Prusinski, et al., "Pulsating Electromagnetic Field in the Therapy of Headache," Hungarian Symposium on Magnetotherapy, 2nd Symposium, May 16-17, 1987, Szekesfehervar, Hungary, p. 163-166.

In this study, 90 headache patients were treated with pulsating electromagnetic fields via large coils to the body for 20 minutes per day for a total of 15 days. Results found the treatment to be either excellent or good for those patients suffering from migraine, tension, and/or cervical headaches.

A. Prusinski, et al., "Pulsating Electromagnetic Field in the Therapy of Headache," Journal of Bioelectr., 7(1), 1988, p. 127-128.

Results of this study indicated that pulsating electromagnetic fields (12 Hz and 5 mT) were an effective prophylactic treatment for patients suffering from cervical and migraine headaches.

J. Giczi & A. Guseo, "Treatment of Headache Pulsating Electromagnetic Field a Preliminary Report," Hungarian Symposium on Magnetotherapy, 2nd Symposium, May 16-17, 1987, Szekesfehervar, Hungary, p. 74-76.

This placebo-controlled, double-blind study examined the effects of pulsed electromagnetic fields (2-5 Hz and flux densities of 3-4 mT) on patients suffering from migraine headaches. PEMFs were administered to the head for 10-15 minutes per day over a period of 30 days. Results showed a mean improvement level of 66 percent in patients receiving the treatment, compared to just 23 percent among controls.

L. Lazar & A. Farago, "Experiences of Patients Suffering from Migraine-Type Headache Treated with Magnetotherapy," Hungarian Symposium on Magnetotherapy, 2nd Symposium, May 16-17, 1987, Szekesfehervar, Hungary, p. 137-140.

HEART DISEASE / HYPERTENSION

Results of this study found that the addition of magnetotherapy to the treatment of patients suffering from ischemic heart disease and osteochondrosis led to clinical improvements.

I. Rodin, et al., "Use of Low-Intensity Eddy Magnetic Field in the Treatment of Patients with Skin Lymphomas," Voen Med Zh, 317(12), 1996, . 32-34.

Results of this study involving 23 parasystolic children found that

low-frequency magnetic field exposure improved humoral and cellular processes involved in the regulation of cardiac rhythm. *M.A. Dudchenko, et al., "The Effect of Combined Treatment with the Use of Magnetotherapy on the Systemic Hemodynamics of Patients with Ischemic Heart Disease and Spinal Osteochondrosis," Lik Sprava, (5), May 1992, . 40-43.*

The authors of this study report on their administering of pulsed magnetic fields to diseases of the leg vessels. Results indicated positive effects on peripheral capillaries in 75- 82 percent of patients receiving the treatment at a pre-gangrene stage.

E.M. Vasil'eva, et al., "The Effect of a Low-frequency Magnetic Field on Erythrocyte Membrane Function and on the Prostanoid Level in the Blood Plasma of Children with Parasystolic Arrhythmia," Vopr Kurortol Fizioter Lech Fiz Kult, (2), March-April 1994, . 18-20.

Results of this study showed exposure to low-frequency alternating magnetic fields had beneficial effects in children with primary arterial hypertension, as seen in the attenuation of sympathetic and vagotonic symptoms.

Y.B. Kirillov, et al., "Magnetotherapy in Obliterating Vascular Diseases of the Lower Extremities," Vopr Kurortol Fizioter Lech Fiz Kult, (3), May-June 1992, . 14-17.

This study demonstrated that traveling pulsed magnetic fields produced beneficial effects in patients suffering from the initial stages of essential hypertension.

V.S. Zadionchenko, et al., "Prognostic Criteria of the Efficacy of Magnetic and Magnetic-laser Therapy in Patients with the Initial Stages of Hypertension," Vopr Kurortol Fizioter Lech Fiz Kult, (1), January-February 1997, . 8-11.

In this article, the authors propose a new approach to treating atherosclerosis through the alteration of biophysical properties both intracellularly and extracellularly. Citing their own preliminary data, they suggest atherosclerotic lesions might be selectively resolved without harming normal blood vessels allowing the lesions to take up the magnetically excitable submicron particles and then applying an external alternating electromagnetic field.

R.T. Gordon & D. Gordon, "Selective Resolution of Plaques and Treatment of Atherosclerosis Biophysical Alteration of "Cellular" and "Intracellular" Properties," Medical Hypotheses, 7(2), February 1981, . 217-229.

This study examined the effects of magnetic fields on essential hypertension patients. Results indicated the treatment decreased

arterial pressure in stage II patients, with magnetotherapy being shown to produce beneficial effects on the central hemodynamics and microcirculation.

S.G. Ivanov, et al., "The Magnetotherapy of Hypertension Patients," Ter Arkh, 62(9), 1990, . 71-74.

Results from several recent studies conducted the author are reviewed. Conclusions are that pulsed electromagnetic fields exhibit protective effects against necrosis from acute ischemia in rats, cerebral infarcts in rabbits, and myocardium infarcts in rats. *R. Cadossi, "Protective Effect of Electromagnetic Field Exposure on Acute Soft Tissue Ischaemic Injury," Second World Congress for Electricity and Magnetism in Biology and Medicine, 8-13 June 1997, Bologna, Italy.*

This study examined the effects of extremely high frequency electromagnetic radiation (EHF EMR) in 93 patients suffering ischemic heart disease. EHF treatment consisted of 10 to 15 exposures of the lower end of the sternum. Treatment was performed five times weekly for a total of 30 minutes per day, with drug therapy being maintained during this period. Positive results tended to occur after 5 to 6 treatment sessions, with a good or satisfactory response being reported in 82 of 93 patients, and lasting as long as 11 months after hospital release.

I.E. Ganelina, et al., "Electromagnetic Radiation of Extremely High Frequencies in Complex Therapy for Severe Stenocardia," Millimetrovie Volni v Biologii I Meditsine, (4), 1994, . 17-21.

This review article concerning the clinical application of electromagnetic fields notes that microwave therapy has been shown to improve local circulation and vascular tone, increase the volume of functional capillaries, lower hypertension, stimulate protein and carbohydrate metabolism, stimulate the pituitary-adrenal system, produce anti-inflammatory effects, and improve digestive organ function. Studies have shown decimeter wave therapy capable of stimulating the secretory function of the stomach, as well as blood circulation, respiratory function, and the immune system. No side effects have been reported in both human and animal studies.

V.V. Orzeshkovskii, et al., "Clinical Application of Electromagnetic Fields," in I.G. Akoevs & V.V. Tiazhelov, (eds.), Topics of Experimental and Applied Bioelectromagnetics. A Collection of Research Papers, Pushechino, USSR, USSR Academy of Sciences, Biological Sciences Research Center, 1983, . 139-147.

In this study, 30 myocardial infarction patients received millimeter-

wave (MW) therapy in the form of 10 exposures of 30 minutes per day, with a 2-day interruption after the fifth exposure. Patients continued conventional drug treatment during the MW therapy period. Better results were seen in those patients exposed to the MW therapy relative to an equal number of patients receiving conventional treatment only.

N.N. Naumcheva, "Effect of Millimeter Waves on Ischemic Heart Disease Patients," Millimetrovie Volni v Biologii I Medicne, (3), 1994, . 62-67.

This study examined the effects of millimeter wave therapy in approximately 450 patients suffering from a variety of diseases, including those of the musculoskeletal, digestive, pulmonary, and nervous systems. Treatment consisted of 25-30 minutes per day and generally lasted for a period of up to 10 days. Results showed positive effects in over 87 percent of the patients.

A.P. Dovganiuk & A.A. Minenkov, "The Use of Physical Factors in Treating Chronic Arterial Insufficiency of the Lower Limbs," Vopr Kurortol Fizioter Lech Fiz Kult, (5), 1996, . 7-9.

Results of this study found that the use of magnetophore therapy (constant magnets applied to adrenal regions 10 hours per day for 15 days) significantly improved symptoms associated with hypertension in about 35 percent of patients studied, with mild improvement seen in 30 percent, and no improvement in 35 percent. Patients receiving decimeter-band waves (460 MHz, field intensity of 35- 45 W, for 10-15 minutes per day for a total of 15 days) experienced similar results.

V.V. Orzheshovski, et al., "Efficacy of Decimeter-Band Waves and Magnetophore Therapy in Patients with Hypertension," Vrach Delo, (1), 1982, . 65-67.

Results of this placebo-controlled study demonstrated a 76-percent effectiveness rate for running impulse magnetic field therapy in a group of arterial hypertensive patients. Treatment consisted of two 25-minute exposures per day over a period of 10-20 total exposures, at frequencies of 10 or 100 Hz and magnetic field intensity of 3 or 10 mT.

L.L.Orlov, et al., " Indications for Using a New Magnetotherapeutic Method in Arterial Hypertension," Soviet Medicine, (8), 1991, . 23-24.

This study examined the efficacy of the reinfusion of autologous blood following magnetic field exposure in hypertensive patients. Positive effects were found in 92 percent of patients receiving the treatment.

I.G. Alizade, et al., "Magnetic Treatment of Autologous Blood in

the Combined Therapy of Hypertensive Patients,” Vopr Kurortol Fizioter Lech Fiz Kult, (1), 1994, . 32-33

This double-blind, placebo-controlled study examined the effects of magnetotherapy in patients suffering from first-or second-stage hypertension. A magnetic field of 50 Hz, 15-25 mT was applied for 15-20 seconds per day for a total of 9-10 days. Results: The treatment improved headaches in 88 percent of patients, dizziness in 89 percent, and irritability in 88 percent. In general, 95 percent of hypertensive patients experienced beneficial effects from the treatment, and the morbidity rate decreased twofold following one course extended over a period of 5-6 months.

E.V. Rolovlev, “Treatment of Essential Hypertension Patients an Alternating Magnetic Field Puncture,” All-Union Symposium: Laser and Magnetic Therapy in Experimental and Clinical Studies, June 16-18, 1993, Obninsk, Kaluga Region, Russia, . 221-223.

This placebo-controlled study examined the effects of constant and of running magnetic fields in patients suffering from stage II hypertension. Results found that constant magnetic fields exhibited benefits in 68 percent of patients treated, and running magnetic fields were helpful in 78 percent. Only 30 percent of controls showed improvement. Constant magnetic field treatment consisted of constant magnets applied to the inner side of the wrist on each hand for 35-40 minutes daily over a period of 7-10 days. Running magnetic field treatment involved 20 minutes per day for a total of 12- 15 days.

S.G. Ivanov, et al., “Use of Magnetic Fields in the Treatment of Hypertensive Disease, ” Vopr Kurortol Fizioter Lech Fiz Kult, (3), 1993, . 67-69.

This double-blind, placebo-controlled study found that magnetotherapy was effective in the treatment of symptoms associated with stage II hypertension, such as headache, dizziness, and cardiodynia. The therapy consisted of permanent circular magnets (16 mT) applied to the inner forearm for 30-45 minutes per day over a period of 10 sessions.

S.G. Ivanov, “The Comparative Efficacy of Nondrug and Drug Methods of Treating Hypertension, ” Ter Arkh, 65(1), 1993, . 44-49.

This controlled study examined the effects of magnetotherapy in patients suffering from neurocirculatory hypotension (low blood pressure) or hypertension (high blood pressure). Treatment consisted of a running pulsed magnetic field for 20 minutes per day over a course of 10 days. Hypertension patients showed a marked improvement with respect to symptoms including

headache, chest pain, extremity numbness, abnormal systolic and diastolic blood pressure, and work capacity.

L.L. Orlov, et al., "Effect of a Running Pulse Magnetic Field on Some Humoral Indices and Physical Capacity in Patients with Neurocirculatory Hypo- and Hypertension," Biofizika, 41(4), 1996, . 944-948.

This study examined the effects of low-frequency alternating magnetic fields in patients suffering from arteriosclerosis or osteoarthritis deformans. Treatment involved 10-15 minute daily leg exposures over a total of 15 days. Results showed the treatment to be effective in 80 percent of arteriosclerosis patients and 70 percent of those with osteoarthritis formans.

A.G. Kakulia, "The Use of Sonic Band Magnetic Fields in Various Diseases," Vopr Kurortol Fizioter Lech Fiz Kult, 3, 1982, . 18-21.

This study examined the effects of low-frequency magnetic fields (25 mT) in patients suffering atherosclerotic encephalopathy. Treatment involved 10-15 minute daily exposures over a total of 10-15 applications. Results showed clinical improvements with respect to chest pain, vertigo, headache, and other symptoms.

S.S. Gabrielian, et al., "Use of Low-Frequency Magnetic Fields in the Treatment of Patients with Atherosclerotic Encephalopathy," Vopr Kurortol Fizioter Lech Fiz Kult, 3, 1987, . 36-39.

HEART RATE VARIABILITY

Exposure to PEMF for 20 minutes resulted in more rapid recovery of heart rate variability, especially in the very low frequency range after physical strain. The study also showed the moderating influence of the subjects' constitutional VLF power on their response to PEMF treatment. These findings have since been replicated in a clinical study and should be taken into consideration when PEMF treatment is chosen.

– *European Journal of Applied Physiology*

HEPATITIS

This double-blind, placebo-controlled study examined the effects of millimeter wave (MW) therapy combined with conventional methods in the treatment of viral hepatitis in children. MW therapy involved 14-15 exposures of, on average, 30 minutes per day at wavelengths of either 5.6 or 7.1 mm. Results indicated the combined treatment to be more effective than conventional treatment only, leading to a more rapid restoration of liver function.

A.A. Shul'diakov, et al., "Electromagnetic Radiation of Millimeter Range in Treatment of Children with Acute Viral Hepatitis," Millimeter Waves in Medicine and Biology, 10th Russian Symposium with International Participation, April 24-26, 1995, Moscow, Russia, p. 21-23.

Results of this study showed that the use of magnetic fields was effective in treating patients suffering from viral hepatitis who had previously not benefited from conventional drug therapies.

I.A. Il'inskii, et al., "Experience with the Use of Glucocorticosteroids and Magnetic Fields in the Intensive Therapy of Severe Forms of Viral Hepatitis," Soviet Medicine, 9, 1978, p. 72-74.

This study examined the effects of magnetotherapy in children suffering from various forms of viral hepatitis. Magnetotherapy consisted of alternating magnetic fields applied to the liver area daily over a total of 10-15 days. Results indicated magnetotherapy led to more rapid and trouble-free recovery.

V.V. Krasnov & A.I. Shilenok, "Magnetotherapy of Hepatitis A and B in Children," Peditriia, 10, 1991, p. 54-57.

HERNIATED DISC

This double-blind, placebo-controlled study examined the effects of magnetotherapy in patients following herniated disk surgery. Results showed that 52 percent of patients receiving the treatment compared to 30 percent of controls reported being free of symptoms at the time of hospital release.

K. Perjes, et al., "Effect of Magnetotherapy on Recovery After Herniated Disk Surgery," Hungarian Symposium on Magnetotherapy, 2nd Symposium, May 16-17, 1987, Szekesfehervar, Hungary, p. 159-162.

HIP PROBLEMS

This double-blind study examined the effects of pulsed electromagnetic fields on loosened hip prostheses. Results showed an increase of bone density in all patients receiving PEMF treatment compared to only 60 percent of controls. The authors argue such findings suggest PEMF elicits early bone reconstruction, which enhances early weight bearing.

G. Gualtieri, et al., "The Effect Pulsed Electromagnetic Field Stimulation on Patients Treated of Hip Revesions with Trans-Femoral Approach," Second World Congress for Electricity and Magnetism in Biology and Medicine, 8-13 June 1997, Bologna, Italy.

INFLAMMATION

It is well known that electromagnetic fields (EMFs) can induce repair of non-healing bone fractures. It is generally believed that non-invasive, EMF therapy might have a broad, albeit currently unrecognized clinical potential. Since T cells are key modulators of inflammation, the development of EMF based therapeutic devices to regulate their activity can be expected to provide important tools to treat numerous human inflammatory diseases such as psoriasis and arthritis. – *Biomedical Sciences Instrumentation*

JOINT DISEASE

Results of this 11-year study involving 3014 patients found pulsed magnetic field treatment at low frequencies and intensities to be a highly effective, side-effectfree therapy for joint disease. *E. Riva Sanseverino, et al., "Therapeutic Effects of Pulsed Magnetic Fields on Joint Diseases," Panminerva Med, 34(4), October-December 1992, p.187-196.*

KIDNEY PROBLEMS

This review article notes that placebo-controlled studies have shown positive results concerning the use of pulsed magnetic field therapy in the treatment of secondary chronic pyelonephritis. *V.A. Kiyatkin, "Pulsed Magnetic Field in Therapy of Patients with Secondary Chronic Pyelonephritis," Second World Congress for Electricity and Magnetism in Biology and Medicine, 8-13 June 1997, Bologna, Italy.*

KNEE PAIN

Low-amplitude, extremely low frequency magnetic fields are safe and effective for treating patients with chronic knee pain due to osteoarthritis. Reduction in pain after a treatment session was significantly greater in the magnetic field-on group (46%) compared to the magnetic field-off group (8%). – *Alternative Therapies in Health and Medicine* [PMID: 10834201](#)

KNEE ARTHRITIS

In patients with symptomatic osteoarthritis of the knee, PEMF treatment can reduce impairment in activities of daily life and improve knee function. – *Wiener Klinische Wochenschrift* [PMID: 11565402](#)

LUMBAR FUSION

Sixty-one randomly selected patients who underwent lumbar fusion surgeries for discogenic low back pain between 1987 and 1994 were retrospectively studied. All patients had failed to respond to preoperative conservative treatments. Forty-two patients received adjunctive therapy with pulsed electromagnetic field (PEMF) stimulation, and 19 patients received no electrical stimulation of any kind. Average follow-up time was 15.6 months postoperatively. Fusion succeeded in 97.6% of the PEMF group and in 52.6% of the unstimulated group. The use of PEMF stimulation enhances bony bridging in lumbar spinal fusions. Successful fusion underlies a good clinical outcome in patients with discogenic low back pain— *Advances in Therapy* [PMID: 12602111](#)

LUNG DISEASE

This study examined the effects of low-frequency magnetic fields coupled with conventional therapies in rats suffering from inflammatory lung disease. Results showed that rats receiving the magnetic fields experienced significant reductions in lung abscesses and associated symptoms, and similar beneficial effects were seen among a group of 165 human patients receiving comparable treatment.

L.V. Iashchenko, "Low-Frequency Magnetic Fields in the Combined Therapy of Inflammatory Lung Diseases," Probl Tuberk, 3, 1988, p. 53-56.

LUPUS ERYTHEMATOSUS

This review article examined the data concerning pulsed magnetic fields in the treatment of lupus erythematosus. Studies indicate that the treatment can be beneficial due to its anti-inflammatory and analgesic effects, its positive action on microcirculation, and immunological reactivity.

I.V. Khamaganova, et al., "The Use of a Pulsed Magnetic Field in the Treatment of Lupus Erythematosus," Ter Arkh, 67(10), 1995, p. 84-87.

Results of this study indicated that the bitemporal application of ultrahigh-frequency electromagnetic fields to the hypothalamo-hypophyseal area daily over a period of 18-20 days had beneficial effects in patients suffering from systemic lupus erythematosus.

V.D. Sidorov, et al., "The Immunomodulating Effect of Microwaves

and of an Ultrahigh-Frequency Electrical Field in Patients with Systemic Lupus Erythematosus,” Vopr Kurortol Fizioter Lech Fiz Kult, (4), 1991, p. 36-40.

MIGRAINE / HEADACHES

In the active-treatment group, all assessed criteria were significantly improved at the end of the migraine/headache study. 76% of active-treatment patients experienced clear or very clear relief of their complaints. Only 1 placebo-patient (2.5%) felt some relief; 8% noted slight and 2% reported significant worsening of symptoms. No side effects were noted. – *Advances in Therapy*

[PMID: 11010056](#)

Ten of the 22 subjects who had actual exposure received 2 additional weeks of actual exposure after their initial 1-month follow-up. All showed decreased headache activity (50% good, 38% excellent). Thirteen subjects from the actual exposure group elected not to receive additional exposure. Twelve of them showed decreased headache activity by the second month (29% good, 43% excellent). Eight of the subjects in the placebo group elected to receive 2 weeks of actual exposure after the initial 1-month follow-up with 75% showing decreased headache activity (38% good, 38% excellent). In conclusion, exposure to pulsing electromagnetic fields for at least 3 weeks is an effective, short-term intervention for migraine, but not tension headaches. –

Headache [PMID: 11571822](#)

MULTIPLE SCLEROSIS

There is a growing literature on the biological and clinical effects of pulsed electromagnetic fields. Some studies suggest that electromagnetic therapies may be useful in the treatment of chronic illnesses. This study is a follow-up to a placebo controlled pilot study in which multiple sclerosis (MS) patients exposed to weak, extremely low frequency pulsed electromagnetic fields showed significant improvements on a composite symptom measure. Evidence from this randomized, double-blind, placebo controlled trial is consistent with results from smaller studies suggesting that exposure to pulsing, weak electromagnetic fields can alleviate symptoms of MS. – *Alternative Therapies in Health and Medicine* [PMID: 11279973](#)

Fatigue is the most common symptom of multiple sclerosis. 75%-90% of patients with multiple sclerosis report having fatigue, and 50%-60% describe it as the worst symptom of their disease. Fatigue is significantly associated with reduced quality of life and

is also a major reason for unemployment, especially for patients with otherwise minor disability. There is evidence that pulsing electromagnetic fields may improve fatigue associated with multiple sclerosis. – *Wien Med Wochenschr.* [PMID: 12868251](#)

Recent clinical reports have suggested that treatment with extremely weak magnetic fields (MF) in the picoTesla range is an efficacious modality for the symptomatic therapy in patients with multiple sclerosis (MS) during the remission and exacerbation periods of the disease. The report attests to the unique efficacy of extremely weak MF in the symptomatic treatment of patients with MS including those patients with a chronic progressive course of the disease and supports the hypothesis that dysfunction of synaptic conductivity due to neurotransmitter deficiency specifically of serotonin rather than demyelination underlies the neurologic deficits of the disease. – *International Journal of Neuroscience* [PMID: 12658965](#)

MUSCLE INJURY

This study examined the effects of pulsed electromagnetic fields on recovery following muscle injury in rats. Results showed that both pulsed and constant magnetic fields were equally effective, with the constant field being more intense.

I.E. Detlav, The Influence of Constant and Pulsed Electromagnetic Fields on Oxidation Processes in Muscle, in I.E. Detlav, (ed.), Electromagnetic Therapy of Injuries and Diseases of the Support-Motor Apparatus. International Collection of Papers, Riga, Latvia: Riga Medical Institute, 1987, p. 12-16.

MYOFASCIAL PAIN

The repetitive magnetic stimulation (rMS) group showed a significant improvement in VAS, NPDVAS, algometry, as well as in the characteristics of the therapy device after conclusion of treatment. Improvements in the ROM were also present in rotation and contralateral bending. This improvement persisted after 1 month. On the other hand, the placebo group did not show any significant improvement in the tests considered. The results of this study show that peripheral repetitive magnetic stimulation (rMS) may have positive short- and medium-term therapeutic effects on myofascial pain. – *Clinical Neurophysiology* [PMID: 9395691](#)

NERVE DAMAGE

This controlled study found that exposure to pulsed electromagnetic fields enhanced the speed and degree of peripheral nerve regeneration twofold in rats with experimentally severed sciatic nerves.

H. Ito C.A. Bassett, Effect of Weak, Pulsing Electromagnetic Fields on Neural Regeneration in the Rat, Clin Orthop, (181), December 1983, p. 283-290.

Results of this controlled study demonstrated that treatment with 15 minutes per day of pulsed electromagnetic fields enhanced recovery time of experimentally-injured nerves in rats.

A.R. Raji R.E. Bowden, Effects of High-peak Pulsed Electromagnetic Field on the Degeneration and Regeneration of the Common Peroneal Nerve in Rats, Journal of Bone Joint Surg, 65(4), August 1983, p. 478-492.

Results of this study indicated that the use of pulsed electromagnetic fields on experimentally divided and sutured nerves in rats sped up regeneration of damaged nerves and the time it took for limb use to be recovered. - *A.M. Raji, An Experimental Study of the Effects of Pulsed Electromagnetic Field (Diapulse) on Nerve Repair, Journal of Hand Surg, 9(2), June 1984, p. 105-112.*

This study examined the effects of a low-frequency magnet therapy device used to administer approximately 10 mT for approximately 10 minutes in patients with optic nerve atrophy. Patients underwent 10-15 sessions per course. Results showed that vision acuity in patients with low acuity values (below 0.04 diopters) improved in 50 percent of cases. It was also found that the treatment improved ocular blood flow in cases of optic nerve atrophy. Optimal benefits were experienced after 10 therapy sessions.

L.V. Zobina, Effectiveness of Magnetotherapy in Optic Nerve Atrophy. A Preliminary Study, Vestn Oftalmol, 106(5), September-October 1990, p. 54-57.

NEUROLOGICAL DISORDERS

This article summarizes clinical results obtained by the authors in using pulsed electromagnetic fields in the treatment of neurological and locomotor disorders among a group of 148 patients in a hospital setting over a period of 3 years. The authors claim that 58-80 percent of such patients experienced benefits of some kind over the course of magnetotherapy.

G. Terlaki, Clinical Experiences Magnetotherapy, Hungarian Symposium on Magnetotherapy, 2nd Symposium, 16-17 May

1987, Szekesfehervar, Hungary, p. 175-179.

This study examined the effects of magnetotherapy on patients suffering from nervous system diseases. Treatment consisted of 10-12 6-minute exposures (10- 20 kG, 0.1-0.6 Hz). Results indicated beneficial effects in 25 of the 27 patients receiving the treatment.

A.A. Skorometz, Magnetic Impulse Therapy of Patients with Spondylogenic Diseases of the Nervous System, Fizicheskaia Meditzina, 3(1-2), 1993, p. 41-43.

Results of this study found that the use of magnetic fields (30-35 mT, 10 and 100 Hz) produced beneficial effects in 93 percent of patients suffering from nerve problems.

A.G. Shiman, Use of Combined Methods of magnetoelectrotherapy in the Treatment for Polineuropathies, Vopr Kurortol Fizioter Lech Fiz Kult, (5), 1993, p, 38-41.

NEURALGIA

Pulsed radiofrequency treatment has been described as a minimal invasive alternative to radio-frequency thermocoagulation for the management of chronic pain syndromes. We present here our first five high-risk patients with idiopathic trigeminal neuralgia who were treated with pulsed radiofrequency after multidisciplinary assessment; with a mean follow-up of 19.2 months (range 10-26). These patients were at high risk due to age, co-morbidities or previous interventional and surgical treatments. An excellent long-term effect was achieved in three of the five patients, a partial effect in one patient and a short-term effect in one patient. No neurological side effects or complications were reported. – *International Association for the Study of Pain*

NEUROPATHY

The largely unsatisfactory results reported for the pharmacological treatment of diabetic neuropathy has spurred the search for alternative therapies. Clinical and electroneuromyographic studies were performed in 121 patients with diabetic polyneuropathy (DPN) before and after courses of treatment with pulsed electromagnetic fields with complex modulation (PEMF-CM) at different frequencies (100 and 10 Hz). The earliest and most significant electroneuromyographic signs of DPN were found to be decreases in the amplitude of the H reflex and the Hmax/Mmax ratio in the muscles of the lower leg. Application of PEMF-CM facilitated regression of the main clinical

symptoms of DPN, improved the conductive function of peripheral nerves, improved the state of Ia afferents, and improved the reflex excitability of functionally diverse motoneurons in the spinal cord. PEMF-CM at 10 Hz was found to have therapeutic efficacy, especially in the initial stages of DPN and in patients with diabetes mellitus for up to 10 years. – *Neuroscience and Behavioral Physiology* [PMID: 15834546](#)

OSTEOARTHRITIS

An average improvement of 23-61% occurred in the clinical variables observed with active treatment, while 2 to 18% improvement was observed in these variables in placebo treated control patients. No toxicity was observed. The decreased pain and improved functional performance of treated patients suggests that this configuration of PEMF has potential as an effective method of improving symptoms in patients with OA. This method warrants further clinical investigation. – *Journal of Rheumatology* [PMID: 15035963](#)

OSTEOARTHRITIS – KNEE/CERVICAL SPINE

We conducted a randomized, double blind clinical trial to determine the effectiveness of pulsed electromagnetic fields (PEMF) in the treatment of osteoarthritis (OA) of the knee and cervical spine. Matched pair t tests showed extremely significant changes from baseline for the treated patients in both knee and cervical spine studies at the end of treatment and the one month follow up observations, whereas the changes in the placebo patients showed lesser degrees of significance at the end of treatment. PEMF has therapeutic benefit in painful OA of the knee or cervical spine. – *Journal of Rheumatology* [PMID: 8478852](#)

OSTEOCHONDROSIS

This study examined the effects of alternating magnetic fields (50 Hz, 10-50 mT) combined with conservative therapy in patients suffering from spinal osteochondrosis. Treatment consisted of 20-minute exposures over a total of 20- 25 such exposures per course. Results showed clinical benefits in 95 percent of patients receiving the combination treatment compared to just 30 percent among controls.

L.L. Butenko, The Use of Alternating Magnetic Fields in Spinal Osteochondrosis, Mechanisms of Biological Action of Electromagnetic Fields, 27-31 October 1987, Pushchino, USSR, USSR Academy of Sciences, Research Center for Biological Studies, Inst. of Biological Physics, Coordination Council of

Comecon Countries and Yugoslavia for Research in the Fields of Biological Physics, p. 183.

OSTEONECROSIS

This pilot study found that the use of pulsed electromagnetic fields produced beneficial effects in patients suffering from osteonecrosis of the femoral head.

N.S. Eftekhari, Osteonecrosis of the Femoral Head Treated Pulsed Electromagnetic Fields (PEMFs): A Preliminary Report, 1983, p. 306-330.

This study examined the use of pulsed electromagnetic fields in the treatment of osteonecrosis. Compared to published findings concerning surgical treatment, results showed PEMF therapy to be superior in producing improvement. *M. Hinsenkamp, Preliminary Results in Electromagnetic Field Treatment of Osteonecrosis, Bioelectrochem Bioenerg.30, 1993, p. 229-236.*

OSTEOPOROSIS

The objective was to understand the effects of low-frequency pulsed electromagnetic fields (PEMFs) on chronic bony pain, bone mineral density (BMD), bone strength and biochemical markers of bone metabolism in the patients of osteoporosis. Low-frequency PEMFs relieves the pain of primary osteoporosis quickly and efficiently, enhances bone formation and increases BMD of secondary osteoporosis. – *Chinese Medical Journal*

Results of this double-blind, placebo-controlled study indicated that exposure to pulsed electromagnetic fields had beneficial effects in the treatment of patients suffering from painful osteoarthritis of the knee or cervical spine. PEMF therapy consisted of 18 exposures lasting 30 minutes and administered 3-5 times per week.

D.H. Trock, 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, Journal of Rheumatology, 21(10), 1994, p. 1903-1911.

This double-blind, placebo-controlled study indicated that treatment with pulsed electromagnetic fields produced significant favorable effects in patients suffering from osteoarthritis.

D.H. Trock, Treatment of Osteoarthritis with Pulsed Electromagnetic Fields, Bioelectric Repair and Growth Society, Vol. XIII, 13th Annual Meeting, 10-13 October 1993, Dana Point, CA, p. 14.

This double-blind, placebo-controlled study showed that treatment with pulsed electromagnetic fields yielded significant benefits in patients suffering from osteoarthritis of the knee or cervical spine. PEMF therapy (25 G, 5-24 Hz) consisted of 18 30-minute exposures over a period of 3-4 weeks.

A.J. Bollet, Treatment of Osteoarthritis with Pulsed Electromagnetic Fields, European Bioelectromagnetics Association, 2nd Congress, 9-11 December 1993, Bled Slovenia, p. 46.

This controlled study examined the effects of changeable magnetic fields coupled with more conventional therapies in the treatment of patients suffering from osteoarthritis. Magnetic therapy consisted of daily 20 minute exposures for a total of 12 sessions. Results showed more rapid improvements of immunological indices and alleviation of symptoms associated with the disease among patients receiving the combination therapy compared to those treated only conventionally.

L. Yurkiv, The Use of Changeable Magnetic Field in Treatment of Osteoarthritis, European Bioelectromagnetics Association, 3rd International Congress, 29 February-3 March 1996, Nancy France.

OTITIS EXTERNA

This study examined the effects synchronizing pulse waves in the impaired area when treating patients suffering from acute diffuse otitis externa with low-level magnetic fields in combination with conventional therapies. Patients were divided into three groups. The first received ultrahigh-frequency or very-high-frequency electromagnetic waves. The second received 15-minute daily exposures to 50- Hz alternating or pulsating 20-mT magnetic fields. The third group of patients were treated switching on the same magnetic fields only during propagation of the pulse wave through the ear vessels. Results showed a 100 percent recovery rate in patients across all three groups, with recovery taking the least amount of time among those in group 3.

V.V. Sunstov, Treatment of Acute Diffuse Otitis Externa Low-Frequency Magnetic Fields, Vestn Otorinolaringol, 6, 1991, p. 35-38.

PAIN

PEMF exposure in refractory CTS provides statistically significant short- and long term pain reduction and mild improvement in objective neuronal functions. Neuromodulation appears to

influence nociceptive-C and large A-fiber functions, probably through ion/ligand binding. – *Pain Medicine*

PANCREATITIS

This study found that sinusoidal and continuous low-frequency alternating magnetic field generated a Polius-1 apparatus exhibited beneficial effects in patients suffering from chronic pancreatitis.

A.A. Fedorov, The Use of a Low-frequency Magnetic Field in the Combined Therapy of Chronic Pancreatitis, *Vopr Kurortol Fizioter Lech Fiz Kult*, (5), September-October 1990, p. 28-30.

This controlled study examined the effects of combining pulsed electric stimulation and laser light with conventional treatment in patients suffering from acute pancreatitis. Results showed the combined therapy to have the most significant effects in patients with severe forms of the disease.

O.G. Savina, A Low-Frequency Pulsed Current and a Low-Intensity Laser Radiation in the Treatment of Acute Pancreatitis, *Vopr Kurortol Fizioter Lech Fiz Kult*, (2), 1995, p. 39-40.

PARKINSON'S DISEASE

Since brief, extracerebral applications of pico-tesla (pT) range flux intensity electromagnetic fields (EMFs) of low frequency have been shown to produce rapid improvement in motor and cognitive symptoms in PD, it is expected that application these EMFs would lead also to an increase in the amplitude of visual evoked potential (VEP) response. The study demonstrates that in Parkinsonian patients extracerebral application of these EMFs rapidly increases in amplitude of the VEP response and, by inference, cerebral dopamine levels presumably by increasing dopamine release. – *International Journal of Neuroscience*

This article reports on the case of a 73-year-old male Parkinson's patients suffering from disabling resting and postural tremors in the right hand, as well as other symptoms. Two successive 20-minute treatments with AC pulsed electromagnetic fields of 7.5-picotesla intensity and 5-Hz frequency sinusoidal wave led to improvements in visuospatial performance and a legible signature. Significant improvements in Parkinsonian motor symptoms were also seen following additional treatments.

R. Sandyk, Brief Communication: Electromagnetic Fields Improve Visuospatial Performance and Reverse Agraphia in a Parkinsonian Patient, International Journal of Neurosci, 87(3-4), November 1996, p. 209-217

This article reports on the case of a medicated 61-year-old Parkinson's patient who experienced rapid reversal of symptoms following a single external application of picotesla-range magnetic fields.

R. Sandyk R.P. Iacono, Reversal of Visual Neglect in Parkinson's Disease Treatment with picoTesla Range Magnetic Fields, International Journal of Neurosci, 73(1-2), November 1993, p. 93-107.

This article reports on four Parkinson's patients who experienced significant improvement in symptoms following treatment with picotesla-range magnetic fields. Two additional patients suffering from Parkinson's-related dementia experienced significant improvements in visuospatial impairment.

R. Sandyk, Magnetic Fields in the Therapy of Parkinsonism, International Journal of Neurosci, 66(3-4), October 1992, p. 209-235.

Noting that transcranial magnetic stimulation (TMS) is a new and noninvasive method of direct cortical neuron stimulation, this review article discusses recent studies showing that TMS has led to improvements in symptoms associated with Parkinson's disease and depression.

M.S. George, et al., "Transcranial Magnetic Stimulation: A Neuropsychiatric Tool for the 21st Century," Journal of Neuropsychiatry Clin Neurosci, 8(4), Fall 1996, p. 373-382.

Results of this study showed that the application of ELF magnetic fields via a plastic helmet device housing a set of coils (generating fields of 8 Hz and 7.5 pT) produced beneficial clinical effects after 30 minutes in patients suffering Parkinson's disease and multiple sclerosis.

J. Bardasano, Extracranial Device for Noninvasive Neurological Treatments with Pulsating ELF Magnetic Fields, Second World Congress for Electricity and Magnetism in Biology and Medicine, 8-13 June 1997, Bologna, Italy.

This article reports on the cases of two Parkinson's patients who experienced improvements in motor symptoms following treatment with external application of weak electromagnetic fields in the picotesla range.

R. Sandyk, Parkinsonian Micrographia Reversed Treatment with Weak Electromagnetic Fields, International Journal of Neurosci, 81(1-2), March 1995, p. 83-93.

This article reports on the cases of three Parkinson's patients on

full medication who exhibited an improvement in right hemispheric functions following a series of treatments with external application of electromagnetic fields in the picotesla range.

R. Sandyk, "Improvement in Short-term Visual Memory Weak Electromagnetic Fields in Parkinson's Disease, International Journal of Neurosci, 81(1-2), March 1995, p. 67-82.

This article reports on the case of a nonmedicated 49-year-old male Parkinson's patient who experienced a dramatic improvement in motor, depressive, and cognitive symptoms following treatment with brief extracranial applications of picotesla-range electromagnetic fields.

R. Sandyk, "A Drug Naive Parkinsonian Patient Successfully Treated with Weak Electromagnetic Fields, International Journal of Neurosci, 79(1-2), November 1994, p. 99-110.

This article reports on the case of a 61-year-old Parkinson's patient who experienced improvements in the severity of motor problems 30 minutes after treatment with external application of weak electromagnetic fields in the picotesla range. Sham treatment had no such effects in the same patient.

R. Sandyk R.P. Iacono, Reversal of Micrographia in Parkinson's Disease Application of picoTesla Range Magnetic Fields, International Journal of Neurosci 77(1-2), July 1994, p. 77-84.

This article reports on the cases of five Parkinsonian patients on full medication who experienced a marked improvement in performance on Thurstone's Word-Fluency Test following treatment with a series of extremely-low-intensity electromagnetic fields in the picotesla range and of 5-8 Hz frequency.

R. Sandyk, Improvement in Word-fluency Performance in Parkinson's Disease Administration of Electromagnetic Fields, International Journal of Neurosci, 77(1-2), July 1994, p. 23-46.

This article reports on the case of a 69-year-old Parkinsonian patient who was able to discontinue most medication for two weeks following two treatment sessions with extracranial picotesla-range magnetic fields. Symptoms recurred after three weeks and the patient received four more magnetic field sessions on consecutive days after four weeks. The patient was then able to discontinue medications completely.

R. Sandyk, Treatment of Parkinson's Disease with Magnetic Fields Reduces the Requirement for Antiparkinsonian Medications, International Journal of Neurosci, 74(1-4), January-February 1994, p. 191-201.

This article reports on the cases of five medicated Parkinsonian

patients who experienced improvements in motor, behavioral, and autonomic functions, and in visuoconstructional tasks following treatment with extracranial application of magnetic fields in the picotesla range.

R. Sandyk, Reversal of a Visuoconstructional Deficit in Parkinson's Disease Application of External Magnetic Fields: A Report of Five Cases, International Journal of Neurosci, 75(3-4), April 1994, p. 213-228.

This article reports on the cases of three medicated Parkinsonian patients who experienced relief from disabling periods of freezing gait following treatment with extracerebral applications of pulsed electromagnetic fields in the picotesla range.

R. Sandyk, Freezing of Gait in Parkinson's Disease is Improved Treatment with Weak Electromagnetic Fields, International Journal of Neurosci, 85(1-2), March 1996, p. 111-124.

The cases of four nondemented Parkinsonian patients under full medication are discussed in this article. These patients performed poorly on human figure drawing tests administered to measure body image perception. Treatment with extracerebral applications of picotesla-range intensity electromagnetic fields led to marked improvements in body image perception as seen on a repeat of the same test each patient.

R. Sandyk, Improvement of Body Image Perception in Parkinson's Disease Treatment with Weak Electromagnetic Fields, International Journal of Neurosci, 82(3-4), June 1995, p. 269-283.

This article reports on the cases of four medicated Parkinsonian patients who experienced reversal of visuospatial impairments as measured the Clock Drawing Test following treatment with externally applied weak electromagnetic fields of picotesla-range intensity.

R. Sandyk, Reversal of Visuospatial Deficit on the Clock Drawing Test in Parkinson's Disease Treatment with Weak Electromagnetic Fields, International Journal of Neurosci, 82(3-4), June 1995, p. 255-268.

This article reports on the case of a 68-year-old male patient suffering from Parkinson's disease over a period of 7 years. The patient had experienced little relief from traditional medical therapy. Treatment with external application of picotesla-range magnetic fields led to quick improvements with respect to tremor and foot dystonia, gait, postural reflexes, mood, anxiety, and cognitive and autonomic functions.

R. Sandyk K. Derpapas, The Effects of External picoTesla Range

Magnetic Fields on the EEG in Parkinson's Disease, International Journal of Neurosci, 70(1-2), May 1993, p. 85-96.

This article reports on the cases of four Parkinsonian patients who exhibited significant improvements in motor symptoms following treatment with externally applied magnetic fields of picotesla-range intensity.

R. Sandyk K. Derpapas, Further Observations on the Unique Efficacy of PicoTesla Range Magnetic Fields in Parkinson's Disease, International Journal of Neurosci, 69(1-4), March-April 1993, p. 67-83

This article reports on two cases of fully medicated Parkinson's patients who experienced enhanced visuoperceptive functions as measured numerous drawing tests following extracranial treatment with picotesla-range magnetic fields.

R. Sandyk R.P. Iacono, Rapid Improvement of Visuoperceptive Functions picoTesla Range Magnetic Fields in Patients with Parkinson's Disease, International Journal of Neurosci, 70(3-4), June 1993, p. 233-254.

This article reports on the case of a 69-year-old Parkinsonian patient on full medication who experienced a marked improvement on several different drawing tests following 30 minutes of treatment with picotesla-range magnetic fields.

R. Sandyk, The Effects of PicoTesla Range Magnetic Fields on Perceptual Organization and Visual Memory in Parkinsonism, International Journal of Neurosci, 73(3-4), December 1993, p. 207-219

This article reports on the case of a Parkinson's patient suffering from severe movement problems who received treatment with external artificial weak magnetic fields with a frequency of 2 Hz and intensity of 7.5 picotesla over a period of 6 minutes. Results showed a significant attenuation in disability and near total reversal of the symptoms lasting approximately 72 hours. The patient then applied equivalent magnetic fields on a daily basis at home. Sustained improvement was seen throughout an observation of one month.

R. Sandyk, Magnetic Fields in the Treatment of Parkinson's Disease, International Journal of Neurosci, 63(1-2), March 1992, p. 141-150.

This article reports on the case of a 67-year-old male patient suffering from Parkinson's disease and levodopa-related motor fluctuations. Treatment with the application of external weak magnetic fields led to improvements in general Parkinsonian

symptoms along with the amelioration of symptoms.

R. Sandyk, Weak Magnetic Fields in the Treatment of Parkinson's Disease with the Phenomenon, International Journal of Neurosci, 66(1-2), September 1992, p. 97-106.

PELVIC PAIN

Unusually effective and long-lasting relief of pelvic pain of gynecological origin has been obtained consistently by short exposures of affected areas to the application of a magnetic induction device producing short, sharp, magnetic-field pulses of minimal amplitude to initiate the electrochemical phenomenon of electroporation within a 25 cm² focal area. Treatments are short, fast-acting, and economical and in many instances have obviated surgery. – *European Journal of Surgery*

PERIPHERAL NEURITIS

In this study, patients suffering from peripheral neuritis were exposed to high-frequency electromagnetic radiation on acupuncture points. EMR was generated by Electronica-EnF, Aria, and Porog devices with tunable frequencies ranging between 53 and 78 GHz. Treatments were daily and lasted 25 minutes. Results showed full restoration of nerve function in 87 percent of patients.

O. Vassilenko and N.F. Vassilenko, Use of Extremely High Frequency Electromagnetic Radiation for Treating Peripheral Neuritis, Second World Congress for Electricity and Magnetism in Biology and Medicine, 8-13 June 1997, Bologna, Italy.

PERIPHERAL NEUROPATHY

The efficacy of different types of electrotherapy for painful diabetic peripheral neuropathy has been evaluated in 15 studies; the effects of transcutaneous electrical nerve stimulation are consistent. The beneficial effects of prolonged use have been reported in three large studies and one small study. The effects of frequency-modulated electromagnetic neural stimulation were assessed in one large study, and a significant reduction in pain was reported. Treatment with pulsed and static electromagnetic fields has been investigated in two small and three large studies, and analgesic benefits have been reported.

PNEUMONIA

Results of this study showed that magnetic laser therapy

decreased the severity of acute respiratory insufficiency and treatment course, and prevented destructive complications in children with infiltrative acute destructive pneumonia between the ages of 1 and 12 years.

E.A. Gaidashev, An Evaluation of the Effect of Magnetic-laser Therapy on External Respiratory Function in Complicated Forms of Acute Pneumonia in Children, Vopr Kurortol Fizioter Lech Fiz Kult, (3), May-June 1995, p. 2-14.

POST-HERPETIC NEURALGIA

This study found both pulsed magnetic field treatment (20-30 minutes per day) and whole body alternating current magnetic field treatment (30 minutes per day) to be effective therapies for post-herpetic neuralgia in older patients. Pulsed magnetic field treatment consisted of 0.6-T (6-kG) samarium/cobalt magnets surrounded spiral coils generating a maximum 0.1-T pulse. Pads were pasted on the sensory areas innervated the dorsal root of the spinal cord where there was scar-association pain or paresthesia. Stimuli were delivered at 280 V and 8 Hz. Alternating current magnetic field treatment involved a treatment bed consisting of 19 electrodes containing paired coils and with a maximum magnetic flux density around the electrodes of 0.08 T.

C. Kusaka, Pulse Magnetic Treatment and Whole-Body, Alternating Current Magnetic Treatment for Post-Herpetic Neuralgia, Journal of Japanese Biomagnetism Bioelectromagnetics Society, 8(2), 1995, p. 29-38.

PSEUDOARTHROSIS

In this study, 92 congenital pseudoarthrosis patients received treatment with pulsing electromagnetic fields. Results indicated a 76-percent rate of lesion recovery.

J.S. Kort, et al., Congenital Pseudoarthrosis of the Tibia: Treatment with Pulsing Electromagnetic Fields, Clin Orthop, (165), May 1982, p. 124-137.

In this article, the authors report on their own clinical use of electrodynamic field therapy in the treatment of 271 pseudoarthrosis patients over a period of 8 years. They report bony healing in 92 percent of such cases.

F. Lechner, Treatment of Infected Pseudoarthroses with Electrodynamic Field Therapy, Fortschr Med, 97(20), May 24, 1979, p. 943-949.

This study examined the effects of pulsed electromagnetic fields on 91 patients with congenital pseudoarthrosis of the tibia. Results showed an overall success rate of 72 percent.

C.A. Bassett M. Schink-Ascani, *Long-term Pulsed Electromagnetic Field (PEMF) Results in Congenital Pseudarthrosis*, *Calcif Tissue Int*, 49(3), September 1991, p. 216-220.

Results of this study indicated that treatment with pulsed electromagnetic fields had beneficial effects in children suffering from congenital pseudoarthrosis.

M.L. Sutcliffe A.A. Goldberg, *The Treatment of Congenital Pseudoarthrosis of the Tibia with Pulsing Electromagnetic Fields: A Survey of 52 Cases*, *Clinical Orthop*, (166), 1982, p. 45-57.

Results of this study indicated that pulsed electromagnetic fields (72 Hz) can be an effective therapy for patients suffering from lesions associated with congenital pseudoarthroses when treatment is combined with appropriate orthopedic management.

J.S. Kort C.A.L. Bassett, *Role of Electricity in the Treatment of Congenital Pseudoarthrosis of the Tibia*, *Reconstr Surg Traumatol*, 19, 1985, p. 140-146.

PSYCHIATRIC DISORDERS

Noting the well-established dangers associated with electroconvulsive therapy, the author, in this theoretical article, argues that transcranial magnetic stimulation should be looked at as an alternative psychiatric treatment. The author asserts that TMS has several advantages over ECT in that it is painless, noninvasive, and more effective on deep structures of the brain.

T. Zyss, *Deep Magnetic Brain Stimulation – The End of Psychiatric Electroshock Therapy? Medical Hypotheses*, 43(2), 1994, p. 69-74.

RESPIRATORY PROBLEMS

Results of this study showed that the use of low-frequency magnetic fields helped to prevent and treat critically ill patients suffering from pyoinflammatory bronchopulmonary complications, and to prevent such complications as well. G.A. Mozhaev Ilyu Tikhonovskij, *The Prevention and Treatment of Suppurative-inflammatory Complications in the Bronchopulmonary System During Prolonged Artificial Ventilation*, *Anesteziol Reanimatol*, (4), July-August 1002, p. 47-51.

This article reports on the case of a schizophrenic patient suffering from respiratory difficulties associated with neuroleptic withdrawal. Treatment using external application of picotesla-range magnetic fields quickly attenuated the severity of such

problems.

R. Sandyk K. Derpapas, Successful Treatment of Respiratory Dyskinesia with picoTesla Range Magnetic Fields, International Journal of Neurosci, 75(1-2), March 1994, p. 91-102.

ROTATOR CUFF TENDONITIS

The value of pulsed electromagnetic fields (PEMF) for the treatment of persistent rotator cuff tendonitis was tested in a double-blind controlled study in 29 patients whose symptoms were refractory to steroid injection and other conventional conservative measures. At the end of the study 19 (65%) of the 29 patients were symptom-less and 5 others much improved. PEMF therapy may thus be useful in the treatment of severe and persistent rotator cuff and possibly other chronic tendon lesions. – *The Lancet*

SACRAL PAIN

Magnetic stimulation of the sacral nerve roots is used for neurologic examination. However, no one has reported therapeutic efficacy of pain relief from pudendal neuralgia with sacral magnetic stimulation. Sacral magnetic stimulation immediately eliminated the pain. The pain relief lasted between 30 minutes and 56 days (median, 24 hours). Adverse effects were not observed. This pilot study indicates that magnetic stimulation of the sacral nerve roots may be a promising therapeutic modality for pain relief from pudendal neuralgia and sciatica. Further studies should be performed to determine the appropriate intensity and frequency, as well as the utility of a second course, of magnetic stimulation treatment. – *Diseases of the Colon and Rectum* [PMID: 6143039](#)

SPINAL CORD INJURY

The use of oscillating field stimulator treatment in patients with spinal cord injury is safe, reliable, and easy. Compared with the outcomes obtained in compliant National Acute Spinal Cord Injury Study III plegic patients, the results of the present study indicate efficacy, and the FDA has given permission for enrollment of 10 additional patients. – *Journal of Neurosurgery: Spine* [PMID: 15658119](#)

Results of this study found that exposure to constant magnetic fields improved healing in rats with experimentally induced spinal cord injury, and in human patients suffering from spinal cord trauma as well.

E.V. Tkach, Characteristics of the Effect of a Constant Electromagnetic Field on Reparative Processes in Spinal Cord Injuries, Zh Nevropatol Psikhiatr, 89(5), 1989, p. 41-44.

This study examined the effects of functional magnetic stimulation used to treat spinal cord injury in seven male patients. Results showed the treatment to be an effective noninvasive approach.

M.K. Sheriff, Neuromodulation of Detrusor Hyper-reflexia Functional Magnetic Stimulation of the Sacral Roots, British Journal of Urology, 78(1), July 1996, p. 39-46.

STROKE

New methods of rehabilitation should be introduced in order to reduce disability resulting from stroke. During the twelve months of follow-up, effect of low frequency magnetic field on the course of patient rehabilitation following ischemic stroke was evaluated on in-patient (acute and subacute period of the stroke) and outpatient (chronic period) basis. The results obtained indicate beneficial effects of groups of patients. – *Przegląd Lekarski*

There is evidence that electromagnetic stimulation may accelerate the healing of tissue damage following ischemia. We undertook this study to investigate the effects of low frequency pulsed electromagnetic field (PEMF) exposure on cerebral injury. Exposure to pulsed electromagnetic field attenuated cortical ischemia edema on MRI at the most anterior coronal level by 65%. On histologic examination, PEMF exposure reduced ischemic neuronal damage in this same cortical area by 69% and by 43% in the striatum. Preliminary data suggest that exposure to a PEMF of short duration may have implications for the treatment of acute stroke. – *Bioelectromagnetics* [PMID: 17892036](#)

Results of this study demonstrated that treatment with sinusoidal modulated currents coupled with Trans cerebral magnetic fields proved more effective than either therapy on its own in the treatment of stroke patients during the period of early rehabilitation.

F.E. Gorbunov, The Effect of Combined Transcerebral Magnetic and Electric Impulse Therapy on the Cerebral and Central Hemodynamic Status of Stroke Patients in the Early Rehabilitation Period, Vopr Kurortol Fizioter Lech Fiz Kult, (3), May-June 1996, p. 21-24.

This study found that exposure to pulsed electromagnetic fields following focal cerebral ischemia provided significant protection

against neuronal damage, in rabbits.

G. Grant, Protection Against Focal Cerebral Ischemia Following Exposure to a Pulsed Electromagnetic Field, Bioelectromagnetics, 15(3), 1994, p. 205-216 [PMID: 8074737](#)

Results of this study pointed to the efficacy of magnetic field therapy in the treatment of patients suffering from a variety of conditions associated with different brain vascular diseases.

N.Y. Gilinskaia, Magnetic Fields in Treatment of Vascular Diseases of the Brain, Magnitologija, 1, 1991, p. 13-17.

TENDONITIS

Results of this double-blind, placebo-controlled study indicated that pulsed electromagnetic field therapy exhibited significant beneficial effects in the treatment of patients suffering from persistent rotator cuff tendonitis. [PMID: 6143039](#)

TINNITUS (Ringing or buzzing in ears)

At the end of one week of treatment, each patient noted whether their tinnitus had completely disappeared, was improved, unchanged or made worse by the treatment. 45% of the patients who completed the trial were improved by the active device, but only 9% by placebo). We suggest that electromagnetic stimulation may be an effective treatment in some tinnitus sufferers. – *Clinical Otolaryngology and Allied Sciences* [PMID: 8877185](#)

TOURETTE'S SYNDROME

This article reports on the case of a 6-year-old boy suffering from Tourette's syndrome who experienced improvements in visuoconstructional and visuomotor skills, along with more general symptomatic improvements, following the extracranial application of electromagnetic fields in the picotesla range of intensity.

R. Sandyk, Improvement of Right Hemispheric Functions in a Child with Gilles de la Tourette's Syndrome Weak Electromagnetic Fields," International Journal of Neurosci, 81(3-4), April 1995, p. 199-213.

ULCERS (GASTRIC AND DUODENAL)

Results of this study showed that the administration of mill metric electromagnetic waves helped to normalize blood properties,

subsequently improving the effectiveness of more conventional gastric and duodenal ulcer treatment.

M.V. Poslavskii, Treatment of Peptic Ulcer Electromagnetic Irradiation of the Millimetric Range, Sov Med, (1), 1989, p. 29-31.

ULCERS (TROPIC)

This study looked at the effects of conventional trophic ulcer treatment alone and in combination with alternating magnetic field (AMF) or constant magnetic field (CMF) exposures in a group of patients suffering from various types of trophic ulcers of the lower limbs. Results showed an average hospital stay of 31 days in the CMF group and 27 days in the AMF group, compared to 40 days among controls. Based on these and related findings, the authors suggest combination AMF therapy to be most effective.

I.G. Sukhotnik, Comparative Effectiveness of Using Constant and Alternating Magnetic Fields in the Treatment of Trophic Ulcers, Vest Khir, 144(6), 1990, p. 123-124.

This placebo-controlled study examined the effects of pulsed electromagnetic fields in the treatment of decubitus ulcers in hospitalized elderly patients with stage II and III pressure ulcers. Patients received daily PEMF stimulation in conjunction with conventional treatment for a period of up to 5 weeks. The findings were that combined PEMF/conventional treatment was superior to conventional treatment and to the placebo received controls - *S. Comorosan, The Effect of Diapulse Therapy on the Healing of Decubitus Ulcer, Romanian Journal of Physiol, 30(1-2), 1993, p. 41-45.*

This double-blind, placebo-controlled study found that treatment with non thermal pulsed electromagnetic energy accelerated wound healing in spinal cord injury patients suffering from stage II and III pressure ulcers. Energy was delivered in 30-minute periods twice a day for 12 weeks or until sores healed.

C.A. Salzberg, The Effects of Non-Thermal Pulsed Electromagnetic Energy on Wound Healing of Pressure Ulcers in Spinal Cord-Injured Patients: A Randomized, Double-Blind Study, Wounds: A Compendium of

VENOUS INSUFFICIENCY (CHRONIC)

This study examined the effects of alternating magnetic fields (15-20 minutes per day over a period of 20 days) in patients suffering from chronic venous insufficiency, varicose veins, and trophic shin ulcers. Results showed good effects in 236 of the 271 patients

receiving the treatment. Thirty-four patients reported satisfactory effects. Only one patient experienced no effects.

E.I. Pasyukov, et al., "Therapeutic Use of Alternating Magnetic Field in the Treatment of Patients with Chronic Diseases of the Veins of the Lower Limbs," Vopr Kurortol Fizioter Lech Fiz Kult, 5, 1976, . 16-19.

This review article notes that magnetotherapy in a variety of forms has been successfully used in the treatment of chronic venous insufficiency and is a commonly used physical therapy for the condition.

A.P. Dovganiuk, "Balneologic and Physical Therapy of Chronic Venous Insufficiency of Extremities," Vopr Kurortol Fizioter Lech Fiz Kult, 2, 1995, . 48- 49.

This study examined the effects of running impulse magnetic fields in patients suffering from vessel obliteration diseases of the legs. Treatment consisted of 15- 20 whole body exposures (0.5-5 mT, 1-2 Hz) lasting 15-20 minutes each. Results showed treatment led to a significant reduction in the number of patients experiencing leg pain while at rest. Among patients previously unable to walk a 500-m distance, 52 percent were able to complete the distance following treatment. Circulation improved in 75-82 percent of patients.

Y.B. Kirillov, et al., "Magnetotherapy for Obliterative Disease of the Vessels of the Legs," Vopr Kurortol Fizioter Lech Fiz Kult, 3, 1992, .. 14-17.

WOUNDS

Treatment for wounds included two modalities: standard medication and alternating or pulsating magnetic field. Magnetic therapy proved highly effective: wound healing was 3-3.5 times faster while duration of treatment—2-3 times shorter than in standard procedure. Clinically-verified partial adhesion-related intestinal obstruction was eliminated by magnetic procedure in 18 children after combined treatment for lymphosarcoma involving the ileum. – *Volpr Onkol* [PMID: 11147428](https://pubmed.ncbi.nlm.nih.gov/11147428/)

Pulsed radio frequency energy was used as an adjunct to basic wound care of 3 large, long-standing (6 years) stage III and IV pressure ulcers that were unresponsive to conventional therapy. The ulcer on the right foot healed within 4 weeks, the left heel ulcer reduced in size by 95% at 7 months, and the large sacral ulcer healed to closure in 11 months. Conclusion: Pulsed radio frequency energy treatment with basic wound care, if administered early in the course of pressure ulcer therapy, might

avoid the lengthy hospitalizations and repeated surgical procedures necessary for treatment of uncontrolled ulcers, reducing the overall cost of treatment and improving the quality of life for chronically ill or injured patients. – *Journal of Plastic and Reconstructive Surgery* PMID: [19008935](https://pubmed.ncbi.nlm.nih.gov/19008935/)

***** In addition, here are some of the other good Pulsed ElectroMagnetic Field (PEMF) therapy studies I found on PubMed:**

Pulsed electromagnetic field therapy promotes healing and microcirculation of chronic diabetic foot ulcers: a pilot study

<https://www.ncbi.nlm.nih.gov/pubmed/25882659>

Pulsed electromagnetic field therapy for management of osteoarthritis-related pain, stiffness and physical function: clinical experience in the elderly

<https://www.ncbi.nlm.nih.gov/pubmed/24106421>

Extremely low frequency pulsed electromagnetic fields cause antioxidative defense mechanisms in human osteoblasts via induction of $\cdot\text{O}_2^-$ and H_2O_2 .

<https://www.ncbi.nlm.nih.gov/pubmed/29109418>

Electromagnetic transduction therapy in non-specific low back pain: A prospective randomised controlled trial.

<https://www.ncbi.nlm.nih.gov/pubmed/28736490>

The effect of pulsed electromagnetic fields in the treatment of cervical osteoarthritis: a randomized, double-blind, sham-controlled trial

<https://www.ncbi.nlm.nih.gov/pubmed/15986086>

Treatment of whiplash-associated disorders--part I: Non-invasive interventions

<https://www.ncbi.nlm.nih.gov/pubmed/15782244>

Sacral magnetic stimulation for pain relief from pudendal neuralgia and sciatica

<https://www.ncbi.nlm.nih.gov/pubmed/?term=11852346>

Electrochemical therapy of pelvic pain: effects of pulsed electromagnetic fields (PEMF) on tissue trauma.

<https://www.ncbi.nlm.nih.gov/pubmed/?term=7531030>

Spine fusion for discogenic low back pain: outcomes in patients treated with or without pulsed electromagnetic field stimulation.

<https://www.ncbi.nlm.nih.gov/pubmed/?term=11010056>

Effect of low frequency magnetic fields used in magnetotherapy and magnetostimulation on the rehabilitation results of patients after ischemic stroke

<https://www.ncbi.nlm.nih.gov/pubmed/?term=17892036>

Effects of pulsed electromagnetic fields on patients' recovery after arthroscopic surgery: prospective, randomized and double-blind study.

<https://www.ncbi.nlm.nih.gov/pubmed/?term=17333120>

Exposure to a specific pulsed low-frequency magnetic field: a double-blind placebo-controlled study of effects on pain ratings in rheumatoid arthritis and fibromyalgia patients.

<https://www.ncbi.nlm.nih.gov/pubmed/?term=16770449>

Experiments showing that electromagnetic fields can be used to treat inflammatory diseases.

<https://www.ncbi.nlm.nih.gov/pubmed/?term=10834201>