

B. ARTICLES INDICATING MORE SPECIFIC APPLICATIONS
OF THE **PEMF** ELECTROTHERAPEUTIC GENERATORS

PART I

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B1. review articles

In this interview with Dr. C. Andrew L. Bassett, a physician researching the use of pulsed electromagnetic fields for the **past 30 years** at Columbia University's Orthopedic Research Lab, Dr. Bassett notes that approximately 10,000 of the 12,000-plus orthopedic surgeons in the U.S. have used pulsed electromagnetic fields on at least one patient.

Many such surgeons have incorporated the therapy on a more regular basis. He estimates that a total of at least 65,000 patients nationwide have received the treatment, with a probable success rate of between 80 and 90 percent.

Use of the treatment has been primarily in patients suffering from **nonunited fractures, fusion failures, and pseudoarthrosis**.

C.A. Bassett, ;

Conversations with C. Andrew L. Bassett, M.D.

Pulsed Electromagnetic Fields. A Noninvasive Therapeutic Modality for Fracture Nonunion (Interview),

Orthop. Review, 15(12)1986 781-795.

ununited fractures

This **review** article notes that **the use of pulsed electromagnetic fields began in 1974**, and that **250,000 nonunion patients** have received the treatment since. The author argues that success rates are comparable to those of bone grafting, and that PEMF treatment is more cost-effective and free of side effects. The FDA approved PEMF use in 1982, although it remains widely unused due to physician misunderstanding and lack of knowledge concerning the treatment.

A. Bassett, ;Therapeutic Uses of Electric and Magnetic Fields in Orthopedics,; in D.O. Carpenter ; S. Ayrapetyan, (eds.),

Biological Effects of Electric and Magnetic Fields. Volume II: beneficial and Harmful Effects, San Diego: Academic Press, 1994, . 13-48.

united fractures, failed arthrodeses, congenital pseudarthroses

This **review** article makes the following observations with respect to the use of pulsed electromagnetic fields in treating **united fractures, failed arthrodeses, and congenital pseudarthroses**. The treatment has been shown to be more than 90 percent effective in adult patients.

In cases where union does not occur with PEMFs alone after approximately four months, PEMF treatment coupled with fresh bone grafts ensures a maximum failure rate of only 1 to 1.5 percent. For those with delayed union three to four months following fracture, PEMFs appear to be more successful than in patients treated with other conservative methods. For more serious conditions, including infected nonunions, multiple surgical failures, long-standing atrophic lesions, failed knee arthrodeses after removal of infected prostheses, and congenital pseudarthroses, PEMF treatment has exhibited success in most patients.

C.A. Bassett, "The Development and Application of Pulsed Electromagnetic Fields (PEMFs) for Ununited Fractures and Arthrodeses,"

Clin Plast Surg, 12(2),April 1985, p. 259-277.

Chronic Venous Insufficiency

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.

bone repair

This **review** article looks at the **history** of pulsed electromagnetic fields as a means of **bone repair**.

The author argues that success rates have been either superior or equivalent to those of surgery, with PEMF free of side effects and risk.

C.A.L. Bassett,; Historical Overview of PEM-Assisted Bone and Tissue Healing, t;

depression (and other disorders,)

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.

depression

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.

pyelonephritis

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.

lupus erythematosus

This **review** article examined the data concerning impulsed 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.

soft-tissue injuries

Noting that pulsed electromagnetic fields have been used in bone healing for more than 20 years, this **review** article cites recent results from both animal and human studies pointing to the efficacy of PEMF in the treatment of **soft-tissue injuries** as well.

B.F. Sisken J. Walker, Therapeutic Aspects of Electromagnetic Fields for Soft-Tissue Healing, in M. Blank, (ed.),

Electromagnetic Fields: Biological Interactions and Mechanisms, Washington, D.C.: American Chemical Society,1995, p. 277-285.

psoriatic arthritis

In this general **review** article on the treatment of patients with **psoriatic arthritis** with magnetic fields, the authors state that an alternating low-frequency magnetic field (30-40 mT) improves the clinical state of afflicted joints. Such treatments are normally carried out for 30 minutes per day over a period of 15 to 20 days.

V.D. Grigor'eva, et al., "Therapeutic Use of Physical Factors in Complex Therapy of Patients with Psoriatic Arthritis,"

Vopr Kurortol Fizioter Lech Fiz Kult, (6),1995, p. 48-51

trophic ulcers

This **review** article discusses the theoretical and clinical applications of magnetic field therapy in the treatment of **trophic ulcers** of the lower limbs.

A. Sieron, Use of Magnetic Field in Treatment of Trophic Leg Ulcers, Pol Tyg Lek, 46(37-39), September 1991, p. 717-719.

alexia (in multiple sclerosis)

Sandyk R (1995) Reversal of **alexia in multiple sclerosis** by weak EMFs.

Int J Neurosci Nov;83(1-2):69-79. NeuroCommunication Research Laboratories, Danbury, CT 06811, USA.

The occurrence of cognitive deficits in patients with multiple sclerosis (MS) has been known since 1877 when Charcot noted "enfeeblement of memory" in his patients. Cognitive deficits have been reported in almost 50% of patients with a relapsing-remitting course and in a significantly higher % of patients with a chronic progressive course leading to intellectual disability which is often severe enough to preclude employment. MS is considered a form of subcortical dementia and the occurrence of classical cortical disorders such as aphasia, agnosia and apraxia is reported to be rare in the disease.

However, in my experience alexia, a reading impairment unrelated to visual acuity or visual field defects, is common in patients with MS. Recently, I reported that treatment with picotesla range EMFs is an efficacious modality in the management of both the motor and cognitive symptoms of MS. 3 patients with MS who developed alexia as a manifestation of the disease are presented. In all patients the alexia was reversed several months after they began treatment with EMFs. Since alexia usually reflects a disconnection syndrome whereby lesions involving the left visual cortex and the splenium of the corpus callosum disconnect language association areas from visual association areas, it is suggested that reversal of the alexia in these patients by EMFs was related to improved interhemispheric transcallosal transmission of visual information. Also, changes in the metabolism of monoamines, which are involved in visual information processing and reading comprehension, may have been important in causing reversal of the alexia.

This report further supports the unique efficacy of this treatment modality in reversing specific cognitive deficits in MS.

Publication Types: Review **Review, tutorial** PMID: 8746750, UI: 96357640

epilepsy, Parkinson's disease and multiple sclerosis

Jacobson JI (1994) Pineal-hypothalamic tract mediation of picotesla magnetic fields in the treatment of neurological disorders. Panminerva Med Dec;36(4):201-205. Institute of Theoretical Physics and Advanced Studies for Biophysical Research, Jupiter, FL 334377-1418, USA.

The objective of this study is analysis of the clinical efficacy of picotesla magnetic fields in the treatment of **epilepsy, Parkinson's disease and multiple sclerosis**. The method utilized involved the exogenous application of physiologic, very weak magnetic fields to the brain by Sandyk, Anninos, Derpapas and Tsagas. The magnetic device produced a magnetic field ranging from about 5×10^{-8} to about 2.5×10^{-7} Gauss (G) at frequencies of 2-7 Hz. The wave form was sinusoidal and the device was positioned about the posterior portion of the corpus callosum most specifically to influence the pineal gland. Direct correlation of melatonin production with magnetic field stimulation was found. In most cases, the neurological conditions showed amelioration or palliation over an extended period of time. It seemed that resonance was established between the magnetic field and melatonin which could be explained with Jacobson Resonance. These studies begin to point to the explanation of the mechanism of interaction between non-ionizing EM radiation and biological systems. Also, evaluation of the pineal gland as a magneto-sensitive gland may help us understand fundamental conditions in magneto-receptors of biological systems in terms of their piezoelectric nature. Publication Types: Review **Review, tutorial** PMID: 7603740, UI: 95327372

Badea MA, Vasilco R, Sandru D, Paslaru L, Jieanu V, Comorosan S (1993) The effect of pulsed EMF (**Diapulse**) on cellular systems.

Rom J Physiol Jan;30(1-2):65-71. Interdisciplinary Research Group, Fundeni Hospital, Bucharest, Romania.

This was a study of the effect of a 27.12 MHz PEMF (Diapulse) on **microbial growth**.

A strain of K 12 E. coli grown in complete Pennassay medium was subjected to Diapulse action for 30 m, at 8 h and 12 h of growth.

In this experiment, designed to be close to the physiological conditions of open wounds, the PEMF action promoted no increase of cell population, indicating the safety of this type of therapy for wound healing process.

The same K 12 E. coli strain grown in Pennassay medium for 2 h was inoculated into a minimal growth medium and the lagless exponential growth thus obtained was followed spectrophotometrically. Diapulse PEMF was applied to this lagless phase of cellular cultures at 30, 60, and 90 m after inoculation. A slight increase in the number of cells occurred at 2 and 4 h after the Diapulse application, when the cultures were previously subjected to Diapulse action between the period of 60 and 90 m of their growth.

A possible molecular mechanism for these PEMF effects is discussed. PMID: 7982019, UI: 95072991

magnetic stimulation of the nervous system

Barker AT (1991) An introduction to the basic principles of magnetic nerve **stimulation**.

J Clin Neurophysiol Jan;8(1):26-37. Dept of Med Physics and Clinical Engineering, Royal Hallamshire Hospital, Sheffield, UK.

Magnetic nerve stimulation is a new method for the noninvasive stimulation of neuromuscular tissue.

The technique, developed at the Univ of Sheffield, UK, is being increasingly used for both clinical studies and basic research, with some 500 stimulators presently in use worldwide. This paper looks at the development of magnetic stimulation as a clinical tool. The basic physics principles of the technique are outlined, and the different magnetic field waveforms, coil geometrics, and orientations that can be used are discussed. The depth of penetration of magnetic stimulation is compared to that of conventional electrical stimulation using surface electrodes. The former generated lower electric fields at the surface of the body, resulting in greater penetration and the ability to stimulate deep nerves without pain. Magnetic stimulation has many other advantages over electrical stimulation, including being able to stimulate the human brain without discomfort due to the magnetic fields passing through the skull without attenuation. These advantages, along with the limitations of the technique, are discussed.

Finally, data relating to the safety of brain stimulation are summarised in terms of the EM parameters used.

The present generation of magnetic stimulators cause no acute hazards, provided their electrical and mechanical design meets the relevant electromedical safety standards.

Publication Types: Review **Review, tutorial** PMID: 2019648, UI: 91210409

magnetic stimulation of the nervous system

Geddes LA (1991) History of magnetic **stimulation** of the nervous system. J Clin Neurophysiol Jan;8(1):3-9. William A. Hillenbrand **Biomedical Engineering** Ctr, Purdue Univ, West Lafayette, Indiana 47907.

The use of a time-varying magnetic field to induce a sufficiently strong current to stimulate living tissue was first reported by **d'Arsonval in 1896**. Since then, there have been many studies in what is now called magnetic stimulation. This paper traces the history of this field from d'Arsonval to its present use in neurophysiology. Publication Types: Historical article PMID: 2019649, UI: 91210410

magnetic stimulation of the nervous system

Maccabee PJ, Amassian VE, Cracco RQ, Cracco JB, Eberle L, Rudell A (1991) **Stimulation** of the human nervous system using the magnetic coil.

J Clin Neurophysiol Jan;8(1):38-55. Dept of Neurology, State Univ of New York, Brooklyn 11203.

The magnetic coil (MC) is a unique probe that can be used to elucidate basic neurophysiological mechanisms in humans. Either by excitation or inhibition of responding neural elements, we have been able to investigate:

1. the distribution of the electric field induced within isotropic and anisotropic volume conductors by round and figure-8 MCs;
2. the theoretical relationship between electric field distribution and excitation of distal peripheral nerve, nerve root, cranial nerve, and motor cortex;
3. the effect of focal MC stimulation of motor and visual systems;
4. perturbation of sequential digit movements by MC stimulation of human premotor cortex;
5. activation of frontal motor areas related to speech;
6. elicitation of a sense of movement in an ischemic paralyzed limb by focal MC cortical stimulation; and
7. the effect of stimulation of the human visual system to (a) suppress and unmask visual perception using single MC stimuli and (b) prolong visual suppression using short trains of MC stimuli.

In the future, prolongation of MC action by using repetitive stimuli should be useful in further investigating functions concerned with language, speech, and cognition.

Publication Types: Review **Review, tutorial** PMID: 2019650, UI: 91210411

blood pressure (regulation)

Orlov LL, Alekseeva NP, Slutskii II, Galuza GI, Chogovadze VA (1986)

[Various humoral factors **regulating blood pressure** in patients with hypertension during treatment by an impulse magnetic field –

[Article in Russian]. Kardiologiia Mar;26(3):56-60.

Renin activity, aldosterone, prostaglandin (PGF2 alpha and PGB) and cyclic nucleotide levels and catecholamine excretion were measured in 165 essentially hypertensive patients exposed to therapeutic effects of "running" impulse magnetic field (RIMF). The correction of arterial blood pressure in RIMF-treated patients was mediated by BP-controlling humoral factors, the magnitude and direction of changes in levels and activity of biologically-active substances and hormones being determined by their respective baselines.

A decrease of hyperfunction, as reflected in elevated hormonal production, and an increase of hypofunction were the most common therapeutic effect of RIMF exposure.

PMID: 3012184, UI: 86228610

psychiatric treatment (alternative)

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.

therapeutic effects equivalent to E.C.T.

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.

atherosclerosis

Gordon RT, Gordon D (1981) Selective resolution of plaques and treatment of **atherosclerosis** by biophysical alteration of "cellular" and "intracellular" properties. **Med Hypotheses** Feb;7(2):217-229.

This is a totally new approach to effective treatment of atherosclerosis by alteration of biophysical properties both "intracellularly" and "extracellularly." Early results show that by allowing the atherosclerotic lesions to take up the magnetically excitable submicron particles and then applying an external alternating EMF, the atherosclerotic lesions may be selectively resolved without damaging normal blood vessels. This concept suggests many areas of research since there are many ways to alter atherosclerotic plaques biophysically, and many substances may be used to enhance the process. This new technology and this initial experimentation introduces a "new era" in the effective treatment of Atherosclerosis. PMID: 7219246, UI: 81172377

neurologic disorders

Jacobson JI, Yamanashi WS (1994) A **possible**, physical mechanism in the treatment of **neurologic disorders** with externally applied pico Tesla magnetic fields. *Physiol Chem Phys Med NMR* 26(4):287-297.

Institute of Theoretical Physics and Advanced Studies for Biological Research, Jupiter, FL 33477.

The clinical studies describing the treatment of some neurological disorders with an externally applied picoTesla (10(-12) Tesla, or 10(-8) Gauss) magnetic field are considered from a physical view point. An equation relating the intrinsic (or "rest") energy of a charged particle of mass m with its energy of interaction in an externally applied magnetic field B is presented. The equation is proposed to represent an initial basic physical interaction as a part of a more complex biological mechanism to explain the therapeutic effects of externally applied magnetic fields in these and other **neurologic** disorders.

Publication Types: Review **Review, tutorial** PMID: 7700979, UI: 95215493

B2. MEDICAL STUDIES

Alzheimer's Disease

On review, after applying external electromagnetic fields ranging 5 to 8 Hz, large improvements were detected in **Alzheimer's** patients. These included improved visual memory, drawing performance, spatial orientation, mood, short-term memory and social interactions.

R. Sandyk, "Alzheimer's Disease: Improvement of Visual Memory and Visuoconstructive Performance Treatment with PicoTesla Range Magnetic Fields," *International Journal of Neurosci*, 76(3-4), June 1994, p. 185-225.

As generally supported, a persons biological daily clock may causally be related to memory deterioration in **Alzheimer's** patients and in the ageing. Synchronizing of the circadian rhythms using magnetic fields, (this article suggests) could lead to improved memory for those effected.

R. Sandyk, et al., "Age-related Disruption of Circadian Rhythms: Possible Relationship to Memory Impairment and Implications for Therapy with Magnetic Fields," International Journal of Neurosci, 59(4), August 1991, p. 259-262.

Amyotrophic Lateral Sclerosis (Lou Gehrig's Disease)

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.

Ankle Sprain

Results of this double-blind, placebo-controlled study indicated that treatment with two 30-minute sessions of noninvasive pulsed radio frequency therapy is effective in significantly decreasing the time required for **edema reduction** in patients suffering from **lateral ankle sprains**.

A.A. Pilla & L. Kloth, "Effect of Pulsed Radio Frequency Therapy on Edema in Ankle Sprains: A Multisite Double-Blind Clinical Study," Second World Congress for Electricity and Magnetism in Biology and Medicine, 8-13 June 1997, Bologna, Italy, p. 300.

Arthritis

This study on 7 to 14 year old juveniles suffering from rheumatoid arthritis examined effects of low-frequency magnetic fields.

Ten daily treatment exposures of 10 to 12 minutes each was conducted on three experimental groups. The three groups showed 58, 76, 37 percent beneficial effects from the treatment.

E.A. Shlyapok, et al., "Use of Alternating Low-Frequency Magnetic Fields in Combination with **Radon** Baths for Treatment of Juvenile Rheumatoid Arthritis," Vopr Kurortol Fizioter Lech Fiz Kult, 4,1992, p. 13-17.

Blepharitis (infection of the eyelid)

Blepharitis (infection of the eyelid)

Study results indicated that using a **magnetic ointment** containing reduced iron powder, with an alternating magnetic field had beneficial effects with patients suffering from chronic blepharitis.

V.A. Machehkin, et al., "A New Method for Treating Chronic Blepharitis Using Magnetic Compounds and an Alternating Magnetic Field," Vestn Oftalmol, 109(4), July-September 1993, p. 16-18.

Bone Fractures

radius fractures

This study examined the effects of low-frequency electromagnetic fields (1-1000 Hz) on middle-aged female patients suffering from **fresh radius fractures**. Results showed significant increases in scintimetric activity surrounding the fracture area after two weeks of EMF treatment relative to controls.

O. Wahlstrom, ;Electromagnetic Fields Used in the Treatment of Fresh Fractures of the Radius,t;

Bioelectrical Repair and Growth Society, Second Annual Meeting,20-22 September 1982, Oxford, UK, . 26.

fractures of the tibia, femur, and humerus

In this study, 147 patients with **fractures of the tibia, femur, and humerus** who had failed to benefit from surgery received treatment with external skeletal fixation in situ and pulsed electromagnetic fields. Results indicated an overall success rate of 73 percent. Femur union was seen in 81 percent and tibia union in 75 percent.

M. Marcer, et al., "Results of Pulsed Electromagnetic Fields (PEMFs) in Ununited Fractures after External Skeletal Fixation,t;

Clin Orthop, (190),November 1984, . 260-265

bone fractures

This study examined the effects of extremely-low-frequency electromagnetic fields (1-1000 Hz, 4 gauss) on **new bone fractures** of female patients. Results led the authors to suggest that EMF treatment accelerates the early stages of fracture healing.

O. Wahlstrom, "Stimulation of Fracture Healing with Electromagnetic Fields of Extremely Low Frequency (EMF of ELF),

Clin Orthop, (186),June 1984, . 293-301.

"Stimulation of **Fracture Healing** With Electromagnetic Fields of Extremely Low Frequency" (EMF of ELF)

Clinical Orthopedics & Related Research, No. 186, 6/84.

femoral neck fracture

This double-blind, placebo-controlled study examined the effects of pulsed electromagnetic fields in **femoral neck fracture** patients undergoing conventional therapy. PEMF treatment was started within two weeks of fracture, and patients were instructed to make use of the electromagnetic device for 8 hours per day over a 90-day period.

Results showed beneficial effects relative to controls after 18 months of follow-up.

E. Betti, et al., ;Effect of Electromagnetic Field Stimulation on Fractures of the Femoral Neck. A Prospective Randomized Double-Blind Study,; Second World Congress for Electricity and Magnetism in Biology and Medicine,8-13 June 1997, Bologna, Italy.

Bone non-union, delayed union, malunion.

union delayed (preventive effects)

This study examined the **preventive effects** of low-frequency pulsing electromagnetic fields against **delayed union in rat fibular osteotomies** and **diaphyseal tibia fractures** in **humans**.

Results indicated such treatment modulated and accelerated fracture union in both groups.

A.W. Dunn & G.A. Rush, 3d, "Electrical Stimulation in Treatment of Delayed Union and Nonunion of Fractures and Osteotomies," Southern Medical Journal,77(12),December 1984, . 1530-1534.

bone malunion

This article discusses the cases of two children with **bone malunion** following lengthening of congenitally shortened lower legs.

Pulsed sinusoidal magnetic field treatment was beneficial for both patients.

F. Rajewski & W. Marciniak, "Use of Magnetotherapy for Treatment of Bone Malunion in Limb Lengthening. Preliminary Report," *Chir Narzadow Ruchu Ortop Pol*, 57(1-3),1992,. 247-249.

Nonunion (long-bone)

Results of this study showed that 13 of 15 cases of **long-bone nonunion** treated with pulsed electromagnetic fields in combination with **Denham** external fixator united within several months.

R.B. Simonis, et al., "The Treatment of Non-union Pulsed Electromagnetic Fields Combined with a Denham External Fixator,

Injury, 15(4),January 1984, . 255-260.

nonunion

Results of this study found electromagnetic field stimulation to be an effective treatment for **nonunion** among a group of 37 French

L. Sedel, et al., "Acceleration of Repair of Non-unions electromagnetic Fields,

Rev Chir Orthop Reparatrice Appar Mot,67(1), 1981, . 11-23.

nonunions (unresponsive to surgery)

Results of this study found treatment induced pulsing to be beneficial in patients suffering from **nonunions unresponsive to surgery**.

J.C. Mulier & F. Spaas, "Out-patient Treatment of Surgically Resistant Non-unions Induced Pulsing Current

Clinical Results,; *Arch Orthop Trauma Surg*, 97(4), 1980,.293-297.

nonunions

This 7-year study examined data on more than 11,000 cases of **nonunions** treated with pulsed electromagnetic fields for up to 10 to 12 hours per day. Results indicated an overall success rate of 75 percent.

A.A. Goldberg, ;Computer Analysis of Data on More than 11,000 Cases of Ununited Fracture Submitted for Treatment with Pulsing Electromagnetic Fields," Bioelectrical Repair and Growth Society, Second Annual Meeting,20-22 September 1982, Oxford, UK, . 61.

Delayed Unions / Acquired Pseudo-Arthrosis

Cadossi, R. et al., "Low Frequency Pulsing Electromagnetic Fields in the Treatment of **Delayed Unions** and **Acquired Pseudo-Arthrosis**", Abstract, 2nd Annual BRAGS, Oxford, U.K. Sep. 20-22, 1982.

Non-Unions / Pseudarthroses (Surgically-Resistant)

Bassett, C. A. L. et al.; "A Non-Operative Salvage of **Surgically-Resistant Pseudarthroses** and **Non-Unions** by Pulsing Electromagnetic Fields: A Preliminary Report"; Clin. Orthoped. and Rel. Research; No. 124; pp. 128 to 143, (May 1977).

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.

nonunited scaphoid fractures

Results of this study found that 35 of 44 **nonunited scaphoid fractures** 6 months or older healed in a mean time of 4.3 months during pulsed electromagnetic field treatment using external coils and a thumb spica cast.

G.K. Frykman, et al., "Treatment of Nonunited Scaphoid Fractures Pulsed Electromagnetic Field and Cast,"

Journal of Hand Surg, 11(3), May 1986, p. 344-349.

Delayed Union / Nonunion of the Tibia

M.W. Meskens, et al.,

"Treatment of **Delayed Union and Nonunion of the Tibia** Pulsed Electromagnetic Fields. A Retrospective Follow-up,"

Bull Hosp Jt Dis Orthop Inst, 48(2), Fall 1988, p. 170-175.

Bronchitis

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

Cancer (breast)

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,t;Sov Med, (7), 1991, . 25-27.

cancer (Walker's carcinoma)

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.

antitumor agents (into cells incorporation of)

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.

cancer (different forms of)

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.

Cancer (lung)

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.

Cancer (tongue)

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.

Cancer (varius malignancies)

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

Cancer (breast)

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.

Dental Problems

This controlled study examined the effects of adjunctive electromagnetic therapy on **oral surgery recovery**. Patients received the therapy once per day beginning between 3 to 5 days prior to oral surgery. Therapy was maintained until the point of hospital release. Results found the therapy produced significant healing relative to controls, who received conventional treatment only.

L.C. Rhodes, "The Adjunctive Utilization of **Diapulse** Therapy Pulsed High Peak Power Electromagnetic Energy) in Accelerating Tissue Healing in Oral Surgery," Q National Dental Association, 40(1),1981, . 4-11

This study found that patients suffering from **various oral** diseases experienced more rapid healing when treated with both conventional therapies and 30 minutes per day of pulsed electromagnetic fields (5 mT, 30 Hz), as opposed to conventional therapies alone.

V. Hillier-Kolarov & N. Pekaric-Nadj, "PEMF Therapy as an Additional Therapy for Oral diseases

,"European Bioelectromagnetics Association, 1st Congress,23-25 January 1992, Brussels, Belgium.

Chelidze LN, Zhgenti TG, Devdariani ES, Nishnianidze KA, Khomeriki RV (1980)

[Use of an EMF for treating parodontosis - Article in Russian]. Stomatologiia (Mosk) Mar;59(2):91-92. PMID: 6929615, UI: 80192688

hemorrhagic periodontosis

Todorov N, Ignatova B, Stojanova O (1983) [Application of low-frequency impulse magnetic field and **Phytodont** in the treatment of patients with **hemorrhagic periodontosis** - Article in Bulgarian]. Stomatologiia (Sofia) Nov;65(6):20-24. PMID: 6334380, UI: 85066632

Depression

depression

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.

Sandyk R, Anninos PA, Tsagas N (1991) **Magnetic fields and seasonality of affective illness: implications for therapy.**

Int J Neurosci Jun;58(3-4):261-267. Dept of Psychiatry, Albert Einstein College of Med/Montefiore Med Ctr, Bronx, NY 10461.

Seasonal affective disorder is characterized by **recurrent winter depression** associated with hypersomnia, overeating, and carbohydrate craving. The severe form of winter depression affects about 5% of the general population and is believed to be caused by light deficiency. About 70%-80% of patients with winter depression experience attenuation of symptoms when exposed to bright light therapy. Hypotheses pertaining to the pathogenesis of winter depression implicate the effects of light on different characteristics of circadian rhythms. In addition to light, the geomagnetic field is an environmental factor which may be implicated in the pathophysiology of winter depression. There is strong indication that the pineal gland is a magnetosensitive system and that changes in the ambient magnetic field alter melatonin secretion and synchronize the circadian rhythms. In man, shielding of the ambient magnetic field significantly desynchronizes circadian rhythms which could be gradually resynchronized after application of magnetic fields. The strength of the environmental magnetic field diminishes during the winter months, leading to increased susceptibility for desynchronization of circadian rhythms. Thus, since the acute application of magnetic fields in experimental animals resembles that of acute exposure to light with respect to melatonin secretion (it suppresses melatonin secretion), magnetic treatment might be beneficial for patients with winter depression. Also, since the environmental light and magnetic fields, which undergo diurnal and seasonal variations, influence the activity of the pineal gland, we propose that a synergistic effect of light and magnetic therapy in patients with winter depression would be more physiological and, therefore, superior to phototherapy alone.

Publication Types: Review **Review, tutorial** PMID: 1365047, UI: 95088073

Diabetes

Diabetes (purulent wounds)

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.

vascular complications (diabetics)

Kirillov IB, Suchkova ZV, Lastushkin AV, Sigaev AA, Nekhaeva TI (1996)

[Magnetotherapy in the comprehensive treatment of vascular complications of diabetes mellitus –

[Article in Russian]. Klin Med (Mosk) 74(5):39-41. 3

20 diabetes mellitus (DM) patients were exposed to impulsed magnetic field, 100 control DM patients received conservative therapy alone. 270 patients had microangiopathy, macroangiopathy was diagnosed in 50 patients. Magnetotherapy in combination with conservative methods gave good and satisfactory results in 74% of patients versus 28% in control group. Metabolism stabilization resulted in some patients in reduced blood sugar. Use of magnetic field produced faster and longer response than conservative therapy.

PMID: 8999182, UI: 97062022

suppurative wounds (diabetics)

Kuliev RA, Babaev RF, Akhmedova LM, Ragimova AI (1992) [Treatment of **suppurative wounds** in patients with diabetes mellitus by magnetic field and **laser** irradiation - Article in Russian]. Khirurgiia (Mosk) Jul;7-8:30-33.

The efficacy of including a magnetic field, low-intensity laser beam, and their combination in the complex of therapeutic measures was studied in 119 patients with suppurative wounds and diabetes mellitus. With the use of magnetic field or laser beam intoxication diminished, the organism's immunological status was stabilized within a shorter time, the wound process followed a quicker course, and treatment took less time. The magnetic-laser effect has advantages over separate use of these factors. PMID: 1469868, UI: 93108702

Vesovic-Potic V, Conic S (1993) [Use of pulsating high-frequency EMFs in patients with **diabetic neuropathies** and **angiopathies** –

Article in Serbo-Croatian (Cyrillic)]. Srp Arh Celok Lek Aug;121(8-12):124-126. Belgrade Institute of Rehabilitation.

High-frequency PEMF therapy was carried out in 22 patients with diabetic polyneuropathy and angiopathy of the lower extremities (18 M, 4 F, aged 48.2 ± 6.3 yr; 10 insulin-dependent persons, **and 12 on oral antidiabetic treatment**). The aim of the study was to verify the effect of this therapy on symptoms, neurophysiological findings and peripheral circulation. The diagnose of diabetic polyneuropathy was based on the electromyographic examination of foot and calf muscles, measurement of motor nerve conduction velocity of peroneal and tibial nerve, and sensory nerve conduction velocity of sural nerve. Diagnosis of diabetic polyneuropathy was based on EMG examination of the foot and calf muscles, measurement of the motor nerve conduction velocity of peroneal and tibial nerves, and the sensory nerve conduction velocity of the sural nerve. Diabetic angiopathy was diagnosed by oscillometric examination, measurement of skin temperature and claudication distance. The same methods were used to evaluate the therapeutic effect of EMF. Therapy significantly improved the symptoms and all registered parameters of peripheral circulation, but neurophysiological parameters did not change significantly.

Therefore, high-frequency PEMF is recommended for the treatment of diabetic angiopathy.

It can be used as an initial therapy, or combined with physical agents which are commonly used in the treatment of patients with neuropathic changes in lesions of peripheral nerve. PMID: 7725151, UI: 95242150

Diseases of the Larynx

Diseases of the Larynx

Results of this study found that **alternative magnetic field of sound frequency** proved to be an effective treatment in patients suffering from **acute inflammatory** diseases of the larynx.

D.I. Tarasov, et al., "Effectiveness of Local Magnetic Field of the Acoustic Frequency in the Treatment of Patients with **Acute Inflammatory** Diseases of the Larynx," Vestn Otorinolaringol, (6), November-December 1995, . 11-15.

Epilepsy

Sandyk R, Anninos PA (1992) **Attenuation of epilepsy with application of external magnetic fields: a case report.**

Int J Neurosci Sep;66(1-2):75-85. Democriton Univ of Thrace, Dept of Med Physics, Alexandroupolis, Greece.

We found earlier that magnetoencephalographic (MEG) brain measurements in patients with seizure disorders show significant MEG activity often in the absence of conventional EEG abnormalities. We localized foci of seizure activity using the mapping technique characterized by the ISO-Spectral Amplitude (ISO-SA) on the scalp distribution of specified spectral components or frequency bands of the emitted MEG Fourier power spectrum. Also, using an electronic device, we utilized the above recorded activity to emit back the same intensity and frequency of magnetic field to the presumed epileptic foci. Using this method we were able, over the past 2.5 yr, successfully to attenuate seizure activity in a cohort of over 150 patients with various forms of epilepsy. We present a patient with severe epilepsy and behavioral disturbances in whom application of an external artificial magnetic field of low intensity produced a substantial attenuation of seizure frequency which coincided with an improvement in the patient's behavior.

Artificial magnetic treatment may be a valuable adjunctive procedure in the management of epilepsy. PMID: 1304572, UI: 93279926

Genitourinary disorders

Mel'nikova MM, Kunitsyna GA, Toroptsev ND (1983) **[Use of a weak acoustic-frequency magnetic field in the complex treatment of diseases of the internal genital organs of women - Article in Russian]**.

Akush Ginekol (Mosk) Sep;9:55-57. Publication Types: Review PMID: 6359931, UI: 84077586

Varcaccio-Garofalo G, Carriero C, Loizzo MR, Amoruso S, Loizzi P (1995) **Analgesic properties of EMF therapy in patients with chronic pelvic pain**. Clin Exp Obstet Gynecol 22(4):350-354. Institute of Obstetrics and Gynecology II Clinic, Univ of Bari, Italy.

In a prospective uncontrolled trial, 64 women with chronic refractory pelvic pain of at least 6 mo duration, resistant to standard therapies, had EMF therapy on both iliac regions by Thelf Systems apparatus. Therapy was twice/d for 2 h each for 20-40 d. Cases were reassessed after 3 mo. 39 cases (61%) had complete subsidence of pain; 15 patients (23%) had relief during treatment, then mild endopelvic tension at 3-mo; in 10 cases (16%) symptoms eased only during application hours, and were unchanged at follow-up. Treatment outcome was independent of pre-existent psychosocial variables. **Magnetic therapy had a real analgesic effect on pelvic pain, and seemed to contribute to resolution of complex interactions between somatic nociceptive stimuli and psychosocial implications affecting pain perception in these patients**. Publication Types: Clinical trial PMID: 8777794, UI: 96114165

Zaslavskii AOi, Markarov GS, Gelis IuS (1997) **[Electromagnetic urological stimulator - Article in Russian]**.

Med Tekh May;3:42-43.

The paper deals with an EM urological stimulator which generates a modulated low-frequency EMF of **nonthermal** intensity and its brief technical data. It presents a treatment regimen for urolithiasis and recommendations how to use the above therapeutic agent to stimulate urinary function in patients with urolithiasis in order to inoperatively

eliminate urinary calculi and sand which form after extracorporeal shockwave lithotripsy.
PMID: 9312646, UI: 97397893

Jorgensen WA, Frome BM, Wallach C (1994) **Electrochemical therapy of pelvic pain: effects of pulsed EMFs (PEMF) on tissue trauma.** Eur J Surg Suppl 574:83-86.
International Pain Research Institute, Los Angeles, California.

Unusually effective and long-lasting relief of pelvic pain of gynaecological 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 a minimal amplitude to initiate the electrochemical phenomenon of electroporation within a 25 cm² focal area. Treatments are short, fast-acting, economical and in many instances have obviated surgery. This report describes typical cases such as dysmenorrhoea, endometriosis, ruptured ovarian cyst, acute lower urinary tract infection, post-operative haematoma, and persistent dyspareunia in which pulsed magnetic field treatment has not, in most cases, been supplemented by analgesic medication. Of 17 female patients presenting with a total of 20 episodes of pelvic pain, of which 11 episodes were acute, 7 chronic and 2 acute as well as chronic, 16 patients representing 18 episodes (90%) experienced marked, even dramatic relief, while 2 patients representing 2 episodes reported less than complete pain relief. Publication Types: Clinical trial PMID: 7531030, UI: 95143572

Hart disease (*Atherosclerosis, Parasystolic Arrhythmia, Stroke*)

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

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.

Bogdanov NN, Akhmedzhanov MIu, Buiavykh AG (1986) [Optimization of the effects of physical and health resort factors in **ischemic heart disease** and **arterial hypertension** - Article in Russian]. Ter Arkh 58(5):108-111.

Natural and instrumental physical methods were discussed in the therapy, prevention and rehabilitation of 280 patients with **coronary heart disease (CHD)** and 300 patients with **arterial hypertension (AH)**. In the CHD and AH patients, short- and long-term follow-up results showed the efficacy of optimized use of a number of physical factors (precordial and segmental massage, low frequency magnetic field). It is appropriate to expand the concept "nonpharmacological" methods in the control of CHD and AH.
PMID: 3488602, UI: 86290113

Orlov LL, Makoeva LD, Glezer MG, Titov SIu, Arzhanenko OM, Margarian AG, Musev VA, Memetov KA, Belinskaia TF (1992) [Evaluation of antianginal effects of running pulse magnetic field and drug therapy on the physical working capacity and hemodynamics in patients with stable angina pectoris - Article in Russian]. Kardiologiia Feb;32(2):23-26.

The effects of the running pulse magnetic field, antianginal drug therapy and their combinations on the physical capacity were compared in 60 patients with **Functional Classes I-III stable angina pectoris**.

Monotherapy with the running pulse magnetic field was found to produce an antianginal effect in patients with Functional Classes I-II angina pectoris, but the efficacy of drug therapy increased when antianginal drugs were used in combination with running pulse magnetic field in patients with severe angina. PMID: 1527930, UI: 92408123

Orlov LL, Makoeva LD, Glezer MG, Memetov KA, Belinskaia TF, Arzhanenko OM (1991)

[Effects of impulse magnet field and beta adrenergic blockaders on physical work capacity and hemodynamics of patients with neurocirculatory dystonia of the cardiac type - Article in Russian].

Kardiologiia Feb;31(2):36-39. PMID: 2041288, UI: 91251499

Parasytolic Arrhythmia

Results of this study involving 23 parasytolic children found that low-frequency magnetic field exposure improved humoral and cellular processes involved in the regulation of cardiac rhythm.

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 **Parasytolic Arrhythmia**,"

stroke

Results of this study demonstrated that treatment with sinusoidal modulated currents coupled with Tran-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.

Headaches

headaches (cervical and migraine)

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.

headaches

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.

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

headaches (chronic)

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.

headache

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. Patients experiencing post-traumatic or cluster headaches did not experience such benefits.

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

Grunner O (1985) [Cerebral use of a pulsating magnetic field in neuropsychiatry patients with long-term headache - Article in German]. EEG EMG Z Elektroenzephalogr Verwandte Geb Dec;16(4):227-230.

40 patients with headaches of various etiology were given pulsed magnetic field therapy (f=260 Hz; t=3 ms; induction B=1.9 mT; gradient=0.5 mT/cm). Each session lasted 0.5 h. Self-assessment statements and EEG changes were used to evaluate changes of headache intensity. EEG frequency analysis showed significant changes in % delta and alpha 1 activities (7.5-9.5/s) after use of the real treatment, as compared with sham treatment.

Improved self-assessment, and EEG were found in headaches associated with **cerebral arteriosclerosis, sequels to cerebral concussion, depressive neurosis, or tension headache.**

Pulsed magnetic field could be applied only where the EEG was physiological. PMID: 3935419, UI: 86081440

Mix E, Jenssen HL, Lehmitz R, Lakner K, Hitzschke B, Richter M, Heydenreich A (1990) [Effect of pulsating EMF therapy on cell volume and phagocytosis activity in *multiple sclerosis* and **migraine** - Article in German]. Psychiatr Neurol Med Psychol (Leipz) Aug;42(8):457-466.

Neurologische Abteilung, Universitat Rostock. PEMF treatment was studied in 10 patients with **multiple sclerosis** and 10 patients with **migraine**. In both patients' groups a single treatment induced a significant rise of yeast particle uptake by blood granulocytes. The % of phagocytizing cells was increased in migraine patients only. In both groups 20 PEMF treatments caused a reduction of particle uptake, whereas the % of phagocytizing cells remained unchanged. In migraine patients the opsonic capacity of serum and the mean cell volume of erythrocytes, lymphocytes and granulocytes were initially reduced, but increased during the course of 20 PEMF treatments. The biphasic changes of cell volume and phagocytic activity are interpreted as a result of counter-regulation of the organism in response to the primary PEMF effect. PMID: 2247525, UI: 91062477

Hepatitis

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," *Pediatrics*, 10, 1991, p. 54-57.

Herniated Disk

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.

Hypertension

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.

hypertension (stage II)

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 the use of the apparatus for 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.

hypertension

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 0.5 mT, 300 Hz administered for 20 minutes per day over a course of 10 days. Patients suffering from hypotension did not benefit significantly from the magnetotherapy. Hypertension patients, however, 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.

hypertension

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.

hypertension

This study demonstrated that traveling pulsed magnetic field and magnetic laser treatment 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.

Orlov LL, Alekseeva NP, Galuza GI, Slutskii II, Drozdov IuF (1985)

[Hemodynamic and humoral mechanisms of the therapeutic effect of the "travelling" impulse magnetic field in hypertension - Article in Russian].

Vopr Kurortol Fizioter Lech Fiz Kult Jan;1:23-27. PMID: 3984249, UI: 85169867

Miasnikov IG (1992) **[Magnetotherapy of initial manifestations of cerebrovascular disorders in hypertension –**

[Article in Russian]. Zh Nevropatol Psikhiatr Im S S Korsakova 92(1):63-67.

The paper is concerned with the data on 147 subjects who underwent magnetotherapy applied to the **cervical area**.

The main group included 102 subjects, 45 person served as control. The purpose of the work was to base the application of MT under inpatient and home conditions with the use of the above-indicated unit. In view of this fact, a study was made of cerebral hemo- and thermodynamics with the aid of rheoencephalography and encephaloradiothermography under the action of different modes of the functioning of the unit (pulse and variable magnet induction fields 12-15 mTl and 30-35 mTl). A method of measuring magnetosensitivity of patients depending on the temperature reaction of the brain to a single MT session was elaborated.

The greatest clinical effect was attained with the use of pulse magnetic field 15 mTl.

Magnetotherapy gave good results under inpatient and home conditions. The magnetosensitive patients had the highest effect.

PMID: 1319653, UI: 92312254

Hip Problems

hip prostheses (loosened)

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 Revisions with Trans-Femoral Approach," Second World Congress for Electricity and Magnetism in Biology and Medicine, 8-13 June 1997, Bologna, Italy.

hip prostheses (aseptic loosening of)

This study examined the effects of pulsed electromagnetic fields (50 Hz, 50 G) in treating **aseptic loosening of total hip prostheses**.

PEMF therapy consisted of 20 minutes per day for 6 days per week over a total of 20 such sessions and was begun, on average, a year and a half following the start of loosening. Results showed PEMF to have some beneficial effects with respect to loosened hip arthroplasties, although it was not effective in patients suffering severe pain due to extreme loosening.

Therapy with pulsed electromagnetic fields in **aseptic loosening of total hip prostheses**: a prospective study.

Konrad K, Sevcic K, Foldes K, Pirooska E, Molnar E. Clin Rheumatol 1996 Jul;15(4):325-8

Országos Reumatológiai és Fizioterápiás Intézet, Budapest, Hungary.

Aseptic loosening is the most common problem of hip arthroplasties, limiting its long term success. We report a study of pulsed electromagnetic field (PEMF) treatment in 24 patients with this complication. At the end of treatment, six months and one year later, pain and hip movements improved significantly with the exception of flexion and extension. There was significant improvement in both isotope scans and ultrasonography, but not in plain X-ray. The decreased pain and improved function suggest that PEMF is effective in improving symptoms of patients with loose hip replacement.

No improvement, however, can be expected in patients with severe pain due to gross loosening.

PMID: 8853163 [PubMed - indexed for MEDLINE]

hip degenerative arthritis

Results of this double-blind study showed significant healing effects of low-frequency pulsing electromagnetic fields in patients treated with **femoral intertrochanteric osteotomy for hip degenerative arthritis**.

G. Borsalino, et al., "Electrical Stimulation of Human Femoral Intertrochanteric Osteotomies.

Double-Blind Study," Clin Orthop, (237), December 1988, . 256-263.

Joint Disease

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-effect-free 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.

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B. ARTICLES INDICATING MORE SPECIFIC APPLICATIONS

OF THE PEMF ELECTROTHERAPEUTIC GENERATORS

PART II

[Click here to return to PART I](#)

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.

Lupus Erythematosus

This review article examined the data concerning impulsed 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.

Multiple Sclerosis

multiple sclerosis

This article reports on the cases of three patients suffering from long-time symptoms of **multiple sclerosis** who received treatment with extra cerebral pulsed electromagnetic fields over a period of between 6 and 18 months. Results showed all three patients experienced significant improvements in cognitive functions.

R. Sandyk, "Progressive Cognitive Improvement in Multiple Sclerosis from Treatment with Electromagnetic Fields,

" International Journal of Neurosci, 89(1-2),January 1997, p. 39-51.

multiple sclerosis

This is a report on the cases of two chronic **multiple sclerosis** patients exhibiting severe speech problems. Symptoms were completely resolved following 3-4 weeks of treatment with pulsed electromagnetic fields.

R. Sandyk, "Resolution of Dysarthria in Multiple Sclerosis Treatment with Weak Electromagnetic Fields,

" International Journal of Neurosci, 83(1-2),November 1995, p. 81-92.

multiple sclerosis

Results of this double-blind, placebo-controlled study found that pulsed electromagnetic fields administered daily over a period of 15 days proved to be an effective treatment in reducing spasticity and incontinence associated with **multiple sclerosis**.

A. Guseo, Double-Blind Treatments with Pulsating Electromagnetic Field in Multiple Sclerosis,

Hungarian Symposium on Magnetotherapy, 2nd Symposium,May 16-17, 1987, Szekesfehervar, Hungary, p. 85-89.

multiple sclerosis

Results of this double-blind, placebo-controlled study indicated that pulsed electromagnetic fields administered daily over a period of 15 days is a generally effective treatment in reducing symptoms associated with **multiple sclerosis**, with the most positive improvements involving the alleviation of spasticity and pain.

A. Guseo, Pulsing Electromagnetic Field Therapy of Multiple Sclerosis the Gyuling-Bordacs Device: Double-Blind, Cross-Over and Open Studies, Journal of Bioelectr., 6(1),1987, p. 23-35.

multiple sclerosis / Parkinson's disease

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.

Mix E, Jenssen HL, Lehmitz R, Lakner K, Hitzschke B, Richter M, Heydenreich A
(1990)

[Effect of pulsating EMF therapy on cell volume and phagocytosis activity in multiple sclerosis and migraine –

[Article in German].

Psychiatr Neurol Med Psychol (Leipz) Aug;42(8):457-466.

Neurologische Abteilung, Universitat Rostock. PEMF treatment was studied in 10 patients with **multiple sclerosis** and 10 patients with **migraine**. In both patients' groups a single treatment induced a significant rise of yeast particle uptake by blood granulocytes. The % of phagocytizing cells was increased in migraine patients only. In both groups 20 PEMF treatments caused a reduction of particle uptake, whereas the % of phagocytizing cells remained unchanged. In migraine patients the opsonic capacity of serum and the mean cell volume of erythrocytes, lymphocytes and granulocytes were initially reduced, but increased during the course of 20 PEMF treatments. The biphasic changes of cell volume and phagocytic activity are interpreted as a result of counter-regulation of the organism in response to the primary PEMF effect. PMID: 2247525, UI: 91062477

Sandyk R (1996) **Treatment with EMF alters the clinical course of chronic progressive multiple sclerosis: a case report.**

Int J Neurosci Nov;88(1-2):75-82. NeuroCommunication Research Laboratories, Danbury, CT 06811, USA.

It is estimated that 10-20% of patients with multiple sclerosis (MS) have a chronic progressive (CP) course characterized by an insidious of neurological deficits followed by steady progression of disability in the absence of symptomatic remission. No therapeutic modality has shown specific efficacy in the treatment of patients with CP MS and there are no data to show that any pharmacologic or other modality alters the clinical course of CP MS. Treatment with picotesla EMFs is a highly effective modality for the

symptomatic management of MS including the chronic progressive form. Also, this treatment also seems to alter the natural course of the disease in CP patients. A 36 yr-old man experienced, at the age of 31, insidious weakness in the legs and several months later developed difficulties with balance with ataxia of gait. His gait abnormality progressed slowly over the following years and at the age of 35 he was severely disabled with spastic paraparesis and ataxia using a rolling walker for ambulation and a scooter for longer distances. In particular, his disability had progressed rapidly over the 6 mo preceding the initiation of treatment with EMFs. He was classified as CP MS and his prognosis was considered extremely unfavorable due to the degree of cerebellar and pyramidal tract involvement and the rapid course of deterioration. In July 1995 the patient began experimental treatment with EMFs. While receiving 3 treatment sessions/wk for 12 mo he experienced improvement in cerebellar functions such as gait, balance and tremor as well as bowel and bladder functions, mood, sleep and cognitive function and resolution of diplopia, blurring of vision, dysarthria, paresthesias in the hands, and fatigue. Most remarkably, there was no further progression of the disease during the course of magnetic therapy. This case showed that EMF-treatment **reversed** the clinical course of CP MS in addition to producing symptomatic improvement. PMID: 9003966, UI: 97157687

Mix E, Jenssen HL, Lehmitz R, Lakner K, Hitzschke B, Richter M, Heydenreich A (1990)

[Effect of pulsating EMF therapy on cell volume and phagocytosis activity in multiple sclerosis and migraine - Article in German].

Psychiatr Neurol Med Psychol (Leipz) Aug;42(8):457-466. Neurologische Abteilung, Universitat Rostock.

PEMF treatment was studied in 10 patients with **multiple sclerosis** and 10 patients with **migraine**. In both patients' groups a single treatment induced a significant rise of yeast particle uptake by blood granulocytes. The % of phagocytizing cells was increased in migraine patients only. In both groups 20 PEMF treatments caused a reduction of particle uptake, whereas the % of phagocytizing cells remained unchanged. In migraine patients the opsonic capacity of serum and the mean cell volume of erythrocytes, lymphocytes and granulocytes were initially reduced, but increased during the course of 20 PEMF treatments. The biphasic changes of cell volume and phagocytic activity are interpreted as a result of counter-regulation of the organism in response to the primary PEMF effect. PMID: 2247525, UI: 91062477

Muscle Injury

This study examined the effects of pulsed electromagnetic fields in patients suffering from peripheral muscle paralysis. Treatment consisted of 20-minute exposures (2-50 Hz, 70 G). Results showed 50-Hz pulsed electromagnetic fields to be the most effective level of treatment and that such therapy enhanced muscle irritability in peripheral paralysis patients as well as in healthy controls.

L. Mecseki, The Study of the Efficacy of Magnetotherapy in Peripheral Paralysis,

Hungarian Symposium on Magnetotherapy, 2nd Symposium, 16-17, May 1987, Szekesfehervar, Hungary, p. 149-158.

Neck Pain

This double-blind, placebo-controlled study examined the effects of low-energy pulsed electromagnetic fields administered via soft collars on patients suffering from persistent neck pain. Results indicated significantly beneficial effects following three weeks of treatment.

D. Foley-Nolan, Low Energy High Frequency (**27.12 MHZ**) Therapy for Persistent Neck Pain. Double Blind Placebo Controlled Trial, Bioelectromagnetics Society, 12th Annual, June 10-14, 1990, San Antonio, TX, p. 73.

Nerve Damage

This study examined the effects of a 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

neurological and locomotor 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.

nervous system diseases

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.

nerve problems

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 Magneto-electrotherapy in the Treatment for Polineuropathies,

Vopr Kurortol Fizioter Lech Fiz Kult, (5), 1993, p. 38-41.

Raji AM (1984) **An experimental study of the effects of pulsed EMF (Diapulse) on nerve repair.** J Hand Surg [Br] Jun;9(2):105-112. This study investigates the effects of a PEMF on experimentally divided and sutured common peroneal nerves in rats. Evidence is presented that PEMF accelerates recovery of use of the injured limb and enhances regeneration of damaged nerves. PMID: 6747406, UI: 84266450

intraocular pressure

In this study, patients with primary open-angle glaucoma with compensated **intraocular pressure** were administered magnetotherapy. 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.

Sultanov M Iu, Iskenderov GF, Tagi-zade NS, Seidbekov OS (1992) **[Our experience with the complex treatment of phlegmon of the lacrimal sac - Article in Russian]**. Vestn Oftalmol May;108(3):16-18.

89 patients with lacrimal sac phlegmons, 76 women and 13 men, aged 16 to 78, were given multiple-modality treatment, consisting in Group 1 (43 patients) of traditional methods, such as UHF therapy, antibiotics, sulfonamides, symptomatic therapy, dacryocystorhinostomy after complete cessation of inflammation, and in group 2 (46 patients) including sessions of **intermittent magnetic field (IMF) exposure**, antibiotics, and early dacryocystorhinostomy. Sparing technique was used in all operations, carried out under local anesthesia with 2% procaine or trimecaine. IMF exposure was an effective therapeutic means characterized by antiinflammatory, resolving, and analgesic effects. IMF sessions and early dacryocystorhinostomy enhance cessation of inflammation and improve the treatment efficacy: remote results of surgery were excellent in 80% of Group 1 patients and in 90.9% of Group 2 patients.

IMF exposure halved the terms of medical and social rehabilitation of patients with lacrimal sac phlegmons.

PMID: 1481321, UI: 93127383

glaucoma (open-angle)

In this study, patients with primary **open-angle glaucoma** with compensated intraocular pressure were administered magnetotherapy. 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.

Glaucoma (open-angle)

[The effect of a pulsed electromagnetic field on the hemodynamics of eyes with glaucoma] [Article in Russian]

Tsisel'skii IuV, Kashintseva LT, Skrinnik AV. Oftalmol Zh 1990;(3):154-7

The influence of pulse electromagnetic field (PEMF) on hemodynamics of the eye in **open-angle glaucoma** has been studied by means of a method and a device proposed at the Filatov Institute. The PEMF characteristics are: impulse frequency--50 Hz, exposition--0,02 sec., impulse shape--square, rate of impulse rise--4.10(4) c rate of magnetic induction rise--2.10(4) mT/c, amplitude value of magnetic induction at the impulse height--9.0--8.5 mT, duration of the procedure--7 min., a course--10 sessions. Observations over 150 patients (283 eyes) with latent, initial and advanced glaucoma have shown a positive influence of PEMF on hemodynamics of a glaucomatous eye: a rise of rheographic coefficient and relative volume pulse in 87,99 and 81,63%, respectively. The degree of the rise and restoration frequency of rheographic values of the glaucomatous eye under the influence of PEMF to the age norm was more expressed at initial stages of the glaucomatous process (latent and initial glaucoma).

PMID: 2255478 [PubMed - indexed for MEDLINE]

In this study, patients with **primary open-angle glaucoma** with compensated **intraocular pressure** were administered magnetotherapy.

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.

Shlygin VV, Arnautov LN, Maksimov GV (1993) [**A possible mechanism for treating retinal dystrophy with an EMF** –

[**Article in Russian**]. Biofizika May;38(3):507-510.

A mathematical model is proposed to explain how electromagnetic treatment can restore vision in **retinal dystrophy** induced by pathology of receptive cells. Possible relationship between the treatment efficiency and dystrophy localization is shown.

PMID: 8512960, UI: 93291210

Skripka VK (1981) [**Results of the use of magnetic field in ophthalmology** –

[**Article in Russian**]. Oftalmol Zh 36(6):321-325. PMID: 7312260, UI: 82081265

Tsisel'skii IuV (1990) [**The effect of a pulsed EMF on ocular hydrodynamics in open-angle glaucoma** –

[**Article in Russian**]. Oftalmol Zh 2:89-92.

The influence of PEMF on ocular hydrodynamics in open-angle glaucoma was studied in 150 patients (283 eyes) with latent, initial and advanced glaucoma using the method and the device of the Filatov Institute. Impulse frequency was 50 Hz, duration 0.02 s, pulse form rectangular, rate of pulse rise 4/10(-4) s, rate of magnetic induction rise 2/10(-4) mT/s, amplitude value of magnetic induction at the pulse level 8.0-8.5 mT. The procedure was for 7 m, for 10 sessions. PEMF improved ocular hydrodynamics in **open-angle glaucoma**. It raised aqueous outflow and production, and reduced the Becker's coefficient. Outflow was normalized in 25, 18 and 17% of cases at the latent stage, initial stage and advanced stage, respectively. PEMF is recommended as part of complex treatment of open-angle glaucoma. PMID: 2280950, UI: 91125806

Tsisel'skii IuV, Kashintseva LT, Skrinnik AV (1990) [**The effect of a pulsed EMF on the hemodynamics of eyes with glaucoma - Article in Russian**]. Oftalmol Zh 3:154-157.

The influence of PEMF on ocular hydrodynamics in open-angle glaucoma was studied in 150 patients (283 eyes) with latent, initial and advanced glaucoma using the method and the device of the Filatov Institute. Impulse frequency was 50 Hz, duration 0.02 s, pulse form rectangular, rate of pulse rise 4/10(-4) s, rate of magnetic induction rise 2/10(-4) mT/s, amplitude value of magnetic induction at the pulse level 8.0-8.5 mT. The procedure was for 7 m, for 10 sessions. PEMF improved ocular hydrodynamics in open-angle glaucoma. Rheographic coefficient and relative volume pulse rose in 88 and 82%, respectively. The degree of the rise and restoration frequency of rheographic values of the glaucomatous eye under the influence of PEMF to the age norm was more obvious in latent and initial glaucoma. PMID: 2255478, UI: 91074480

Vainshtein ES, Zobina LV, Gurtovaia EE (1981) [Alternating magnetic field in the treatment of various eye diseases of **vascular** etiology - Article in Russian]. Oftalmol Zh 36(6):325-328. PMID: 7312261, UI: 82081266

Zaslavskii AIu, Markarov GS, Markarova IS, Loskutov IA, Gelis IuS, Tarutin NP (1996) [Ophthalmologic electromagnetic stimulator OFTEMAGS - Article in Russian]. Med Tekh Sep;5:43-45.

They describe the design and specifications of an ophthalmological EM stimulator, its new therapeutic factor (the pulse low-frequency field **combined with a static magnetic field**).

A procedure for treating eye diseases and recommendations how to use the therapeutic factor in ophthalmology are given. PMID: 8992189, UI: 97098985

Osteoarthritis

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 osteo arthritis 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 (Polus-101 device) coupled with more conventional therapies in the treatment of patients suffering from **osteoarthrosis**. 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 Osteoarthrosis,

European Bioelectromagnetics Association, 3rd International Congress, 29 February-3 March 1996, Nancy France.

Osteochondrosis

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

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.

osteonecrosis

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.

Osteonecrosis

"Treatment of **Osteonecrosis** of the Hip with Specific, Pulsed Electromagnetic Fields (PEMFs): A Preliminary Clinical Report"

by C. A. L. Bassett et al, Journal of Bone Circulation.

Osteoporosis

osteoporosis

This study examined the effects of a 72-Hz pulsating electromagnetic field administered for 10 hours per day over a period of 12 weeks on bone density in women prone to **osteoporosis**. Results found significant increases in bone mineral density in the area of EMF exposure.

F. Tabrah, Bone Density Changes in Osteoporosis-prone Women Exposed to Pulsed Electromagnetic Fields (PEMFs),

Journal of Bone Miner Res, 5(5), May 1990, p. 437-442.

osteoporosis

In this study, osteoporosis patients received treatment with pulsed electromagnetic fields (50 G, 50-100 Hz) for 30 minutes per session over a period of two years involving 20 sessions. These subjects were compared to similar patients treated with **calcitonin**. Results indicated PEMF to be effective in reducing pain, and to be even more so when combined with the conventional drug treatment.

T.W. Bilotta, The Use of Low-Frequency Low Magnitude PEMFs in Treatment of Osteoporosis,

Journal of Bioelectr, 8(2), 1989, p. 316.

osteoporosis

This controlled study examined the effects of pulsed electromagnetic fields in women suffering from postmenopausal osteoporosis. Treatment consisted of daily 30-minute exposures for 20 days every six months. Results showed that PEMF treatment combined with 100 IU per day of nasal spray synthetic salmon **calcitonin** arrested bone decrease and significantly increased bone mass relative to patients receiving drug therapy alone.

T.W. Bilotta, Influence of Pulsed Electromagnetic Fields on Post-Menopausal Osteoporosis, First World Congress for Electricity and Magnetism in Biology and Medicine, 14-19 June 1992, Lake Buena Vista, FL, p. 78.

osteoporosis

Results of this study found the use of total-body low-frequency magnetic fields (60 G, 50-100 Hz) to be effective in the treatment of patients suffering from osteoporosis-related symptoms. Treatment consisted of a total of 15 exposures of 30 minutes each.

G. Saveriano S. Ricci, Treatment of Senile Osteoporosis Caused Rachialgia with Low-Frequency PEMFs,

Journal of Bioelectr, 8(2),1989, p. 321.

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.

Pancreatitis

This study found that sinusoidal and continuous low-frequency alternating magnetic field 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.

Parkinson's Disease

Parkinson's disease and depression.

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.

Pseudoarthrosis

Cadossi, R. et al., "Low Frequency Pulsing Electromagnetic Fields in the Treatment of **Delayed Unions** and **Acquired Pseudo-Arthrosis**", Abstract, 2nd Annual BRAGS, Oxford, U.K. Sep. 20-22, 1982.

Pseudarthroses (Surgically-Resistant) / Non-Unions

Bassett, C. A. L. et al.; "A Non-Operative Salvage of Surgically-Resistant Pseudarthroses and Non-Unions by Pulsing Electromagnetic Fields: A Preliminary Report"; Clin. Orthoped. and Rel. Research; No. 124; pp. 128 to 143, (May 1977).

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.

Respiratory Problems

Respiratory Dyskinesia

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.

pyoinflammatory bronchopulmonary complications

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 Iiu Tikhonovskii, 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.

Sleep Disorders

Results of this double-blind, placebo-controlled study indicated that low-energy-emission therapy significantly improved sleeping patterns among patients suffering from **chronic psychophysiological insomnia**.

Therapy was administered 3 times per week, always in late afternoon and for 20 minutes, over a period of 4 weeks.

R. Hajdukovic, Effects of Low Energy Emission Therapy (LEET) on Sleep Structure,

First World Congress for Electricity and Magnetism in Biology and Medicine, 14-19 June 1992, Lake Buena Vista, FL, p. 92.

This double-blind, placebo-controlled study examined the effects of low-energy emission therapy (27 MHz amplitude-modulated electromagnetic fields) in patients suffering from **insomnia**. Treatment consisted of 3 exposures per week over a 4-week period. Results showed significant increases in total sleep time among patients in the treatment group relative to controls.

M. Erman, Low-Energy Emission Therapy (LEET) Treatment for somnia,"

Bioelectromagnetics Society, 13th Annual Meeting, 23-27 June 1991, Salt Lake City, UT, p. 69.

This review article notes that studies have found low-energy emission therapy to be effective in the treatment of **chronic insomnia**, and suggests that it may also be of value for patients suffering from **generalized anxiety** disorders.

C. Guillemainault B. Pasche, Clinical Effects of Low Energy Emission Therapy,

Bioelectromagnetics Society, 15th Annual Meeting, 13-17 June 1993, Los Angeles, CA, p. 84.

Skin Disorders

Aleksaniants GD (1987)

[Use of an EMF and iodine-bromine baths in the complex treatment of patients with circumscribed **scleroderma** –

[Article in Russian].

Vestn Dermatol Venerol 3:56-58. PMID: 3604436, UI: 87266118

Spinal Cord Injury

spinal cord injury

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.

Ligament and tendon problems

Tendonitis (rotator cuff, persistent)

Binder A, Parr G, Hazleman B, Fitton-Jackson S (1984) **Pulsed EMF therapy of persistent rotator cuff tendinitis: A double-blind controlled assessment.** Lancet Mar 31;1(8379):695-698.

The value of PEMF for the treatment of **persistent rotator cuff tendinitis** was tested in a double-blind controlled study in 29 patients whose symptoms were refractory to steroid injection and other conventional conservative measures. The treated group (15 patients) had a significant benefit compared with the control group (14 patients) during the first 4 wk of the study, when the control group received a placebo. In the second 4 wk, when all patients were on active coils, no significant differences were noted between the groups. This lack of difference persisted over the third phase, when neither group received any treatment for 8 wk. At the end of the study 19 (65%) of the 29 patients were symptomless 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**. Publication Types: Clinical trial Randomized controlled trial PMID: 6143039, UI: 84166793

Chard MD, Hazleman BL (1988) Pulsed EMF treatment of **chronic lateral humeral epicondylitis**.

Clin Exp Rheumatol Jul;6(3):330-332. Publication Types: Letter PMID: 3180555, UI: 89029346

Currier DP, Ray JM, Nyland J, Rooney JG, Noteboom JT, Kellogg R (1993)

Effects of electrical and electromagnetic stimulation after anterior cruciate ligament reconstruction.

J Orthop Sports Phys Ther Apr;17(4):177-184. Division of Physical Therapy, Univ of Kentucky Med Ctr, Lexington 40536-0079.

A need exists to develop new methods of neuromuscular electrical stimulation (NMES) that are both effective and relatively pain-free. The purpose of this pilot study was to determine the effects of both NMES and a new method of EM (NMES/**PEMF**) stimulation for reducing girth loss and for reducing pain and muscle weakness of the knee extensor muscles in patients during the first 6 wk after reconstructive surgery of the anterior cruciate ligament (ACL). 17 patients receiving ACL reconstructive surgery participated as a control group (N=3), as an NMES group (N=7), and with combined NMES and **magnetic field stimulation** (NMES/PEMF) (N=7). Patients receiving NMES/PEMF rated each type of stimulation for perceived pain and were measured for their torque. Torque results revealed a mean decrease of 13.1% for NMES/PEMF patients. The mean% of thigh girth decreased 8.3% for controls, 0.5% for NMES, and 2.3% for NMES/PEMF patients.

The NMES/PEMF patients rated NMES as causing about twice the pain intensity as NMES/PEMF during treatments.

Both NMES and NMES/PEMF were effective in reducing girth loss and that NMES/PEMF was less painful than NMES alone in treating patients after ACL reconstruction. PMID: 8467342, UI: 93222888

Devereaux MD, Hazleman BL, Thomas PP (1985) Chronic lateral humeral epicondylitis: a double-blind controlled assessment of pulsed EMF therapy. Clin Exp Rheumatol Oct;3(4):333-336.

PEMFs are beneficial in the treatment of **rotator cuff tendinitis**.

As **lateral humeral epicondylitis (tennis elbow)** is a similar chronic tendon lesion, 30 patients with both clinical and thermographic evidence of tennis elbow were randomly allocated to receive either active or inactive PEMF therapy. Treatment was continued for a minimum period of 8 wk.

At this time there was no statistical difference between the two groups.

Publication Types: Clinical trial Randomized controlled trial PMID: 4085165, UI: 86106969

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 (Trophic)

Alekseenko AV, Gusak VV (1991) [Treatment of **trophic ulcers** of the lower extremities using a magnetic field - Article in Russian].

Klin Khir 7:60-63.

The experience with treatment of 126 patients with ulcerous-necrotic lesion of the lower extremities of different genesis was summarized. A comparative evaluation of the effectiveness of treatment depending on a type of the magnetic field: the constant, alternating, or travelling impulse one was carried out. The most effective was the use of a travelling **impulse magnetic field**. The data give grounds to recommend the wide use of magnetotherapy in the complex treatment of trophic ulcers of the lower extremities.
PMID: 1942838, UI: 92047074

ulcers (decubitus)

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.

ulcers (pressure, stage II and III)

This double-blind, placebo-controlled study found that treatment with **non thermal** pulsed electromagnetic energy (PEMET) accelerated wound healing in spinal cord injury patients suffering from **stage II and III pressure ulcers**. PEMET treatment consisted of pulsed 27.12-MHz energy . Energy was delivered the use of a treatment head placed in wound dressings, 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 Clinical Research and Practice, 7(1),1995, p. 11-16.

ulcers

This double-blind, placebo-controlled study found that treatment with non thermal pulsed radio frequency energy accelerated wound healing in spinal cord injury patients suffering from **stage II and III pressure ulcers**. RF treatment consisted of pulsed 27.12-MHz energy delivered via a treatment head placed in wound dressings, 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, *Ostomy Wound Manage*, 41(3),1995, p. 42-51.

ulcers (recalcitrant, venous)

A portable pulsed electromagnetic field (PEMF) device to enhance healing of **recalcitrant venous ulcers**: a double-blind, placebo-controlled clinical trial. *Br J Dermatol* 1992 Aug;127(2):147-54

Stiller MJ, Pak GH, Shupack JL, Thaler S, Kenny C, Jondreau L.

Ronald O. Perelman Department of Dermatology, New York University Medical Center, New York.

A prospective, randomized, double-blind, placebo-controlled multicentre study assessed the clinical efficacy and safety of pulsed electromagnetic limb ulcer therapy (PELUT) in the healing of recalcitrant, predominantly **venous leg ulcers**. The portable device was used at home for 3 h daily during this 8-week clinical trial as an adjunct to a wound dressing. Wound surface area, ulcer depth and pain intensity were assessed at weeks 0, 4 and 8. At week 8 the active group had a 47.7% decrease in wound surface area vs. a 42.3% increase for placebo ($P < 0.0002$). Investigators' global evaluations indicated that 50% of the ulcers in the active group healed or markedly improved vs. 0% in the placebo group, and 0% of the active group worsened vs. 54% of the placebo group ($P < 0.001$). Significant decreases in wound depth ($P < 0.04$) and pain intensity ($P < 0.04$) favouring the active group were seen. Patients whose ulcers improved significantly after 8 weeks were permitted to continue double-blind therapy for an additional 4 weeks. Eleven active and one placebo patient continued therapy until week 12, with the active treatment group continuing to show improvement. There were no reports of adverse events attributable to this device. We conclude that the PELUT device is a safe and effective adjunct to non-surgical therapy for recalcitrant venous leg ulcers.

Publication Types: Clinical Trial Multicenter Study Randomized Controlled Trial

PMID: 1390143 [PubMed - indexed for MEDLINE]

Ulcers (venous)

[Therapy of venous ulcers using pulsating electromagnetic fields--personal results] [Article in Serbo-Croatian (Roman)]

Duran V, Zamurovic A, Stojanovic S, Poljacki M, Jovanovic M, Durisic S.

Klinika za infektivne i dermatoveneroloske bolesti, Medicinski fakultet, Novi Sad. Med Pregl 1991;44(11-12):485-8

The authors review the results of the treatment of venous varices by a pulsating electromagnetic field (PEMF), by the use of IVEMT-2 apparatus, treated at the Department of Dermatovenerology in Novi Sad and the Institute of Medical Rehabilitation. The treatment was carried out in 18 patients--5 men and 13 women, mean age 56 years, all with **venous varices of post-thrombophlebitic origin**. The number of sessions within the PEMF treatment was 10 per patient, each session lasting 15 min. The results were followed by measuring the varix surface prior to and after the treatment. The number of varices prior to the therapy was 26 and after the treatment was 20. The total surface of the varices before the treatment was 55183.90 mm², the mean surface being 2122.46 mm². After the treatment 6 varices epithelialized, while the total surface was 36902.51 mm². The mean surface of the varices following the treatment was 1845.13 mm². The varix surface reduction rate following the treatment was 33.13%. Considering the number of patients, the obtained results are preliminary and they reflect the benefits of PEMF for epithelialization of venous varices. PMID: 1821449 [PubMed - indexed for MEDLINE]

Ulcers (pressure)

The effects of non-thermal pulsed electromagnetic energy on wound healing of **pressure ulcers** in spinal cord-injured patients: a randomized, double-blind study.

Ostomy Wound Manage 1995 Apr;41(3):42-4, 46, 48 passim Salzberg CA, Cooper-Vastola SA, Perez F, Viehbeck MG, Byrne DW.

The objective of this randomized, double-blind study was to determine if non-thermal pulsed electromagnetic energy treatment significantly increases the healing rate of pressure ulcers in patients with spinal cord injuries. Subjects included volunteers admitted to a Veteran's Administration Hospital in New York over a 2 year period and consisted of 30 male spinal cord-injured patients, 20 with Stage II and 10 with Stage III pressure ulcers. Subjects were given non-thermal pulsed high-frequency electromagnetic energy treatment for 30 minutes twice daily for 12 weeks or until healed. The percentage of pressure ulcers healed was measured at one week. Of the 20 patients with Stage II pressure ulcers, the active group had a significantly increased rate of healing with a greater percentage of the ulcer healed at one week than the control group. After controlling for the baseline status of the pressure ulcer, active treatment was independently associated with a significantly shorter median time to complete healing of the ulcer. Stage III pressure ulcers healed faster in the treatment group but the sample size was limited. For spinal cord-injured men with Stage II pressure ulcers, active non-thermal pulsed electromagnetic energy treatment significantly improved healing.

Publication Types: Clinical Trial Randomized Controlled Trial PMID: 7546114 [PubMed - indexed for MEDLINE]

Ulcers (varicose, chronic)

Treatment of chronic varicose ulcers with pulsed electromagnetic fields: a controlled pilot study. *Ir Med J* 1991 Jun;84(2):54-5

Todd DJ, Heylings DJ, Allen GE, McMillin WP. Department of Dermatology, Belfast City Hospital.

To evaluate the efficacy of pulsed electromagnetic fields (PEMF) in healing of **chronic varicose ulcers**, 19 patients with this condition were included in a double-blind controlled clinical trial. All patients received standard ulcer therapy throughout the duration of the study and were randomly divided into two groups to receive either active or inactive PEMF therapy. Active therapy was provided by the use of a pair of helmholtz coils on a twice weekly basis over a five week period and inactive therapy was provided on an identical regimen with identical coils wound so that no magnetic field was produced when an electric current was passed through them. The clinician and patients were unable to distinguish the active or inactive coils. No statistically relevant difference was noted between the two groups in the healing rates of the ulcer, change in the lower leg girth, pain or infection rates. However there was a trend in favour of a decrease in ulcer size and lower leg girth in the group treated with active PEMF. As PEMF is a novel treatment for chronic varicose ulcers, more work needs to be done to establish treatment parameters and its usefulness in the treatment of this condition.

Publication Types: Controlled Clinical Trial Randomized Controlled Trial PMID: 1894496 [PubMed - indexed for MEDLINE]

ulcers (pressure)

Accelerated wound healing of **pressure ulcers** by pulsed high peak power electromagnetic energy .

Itoh M, Montemayor JS Jr, Matsumoto E, Eason A, Lee MH, Folk FS. *Decubitus* 1991 Feb;4(1):24-5, 29-34

The purpose of this study was to evaluate the effect of pulsed high-frequency, high peak power electromagnetic energy in the healing of pressure ulcers. Patients with **Stage II ulcers** unhealed within three to 12 weeks and those with **Stage III ulcers** unhealed within eight to 168 weeks by conventional methods were included in the study. When electromagnetic energy was added to conventional therapy during the nine-month study, all 22 patients healed as evidenced by photographs and measurements of the ulcers. Stage II ulcers healed in one to six weeks (mean 2.33) and all Stage III ulcers healed in one to 22 weeks (mean 8.85). The increased healing time can provide significant cost savings and improved patient care. PMID: 1994961 [PubMed - indexed for MEDLINE]

Comorosan S, Vasilco R, Arghiropol M, Paslaru L, Jieanu V, Stelea S (1993) **The effect of diapulse therapy on the healing of decubitus ulcer.** *Rom J Physiol Jan*;30(1-2):41-45. Interdisciplinary Research Group, Fundeni Hospital, Bucharest, Romania.

The effect of high peak power PEMF on treatment of pressure ulcers is under investigation. 20 elderly patients, aged from 60 to 84, hospitalized with chronic conditions and bearing long-standing pressure ulcers, are subjected to Diapulse sessions (1-2 daily), parallel to conventional treatment. 5 patients undergo conventional therapy, serving as control and 5 others follow conventional+placebo Diapulse treatment. All patients were daily monitored, concerning their clinical status and ulcers' healing. After a maximum 2-wk treatment, bulge healing rate was: 85% excellent and 15% very good healing under Diapulse therapy; in the placebo group, 80% patients show no improvement and 20% poor improvement; in the control group, 60% patients show no improvement and 40% poor improvement of ulcers. This investigation strongly advises for Diapulse treatment as a modern, uninvasive therapy of great efficiency and low social costs in resolving a serious, widespread medical problem. Publication Types: Clinical trial PMID: 7982015, UI: 95072987

Duran V, Zamurovic A, Stojanovic S, Poljacki M, Jovanovic M, Durisic S (1991) [Therapy of **venous ulcers** using pulsating EMFs: personal results - Article in Serbo-Croatian (Roman)]. Med Pregl 44(11-12):485-488. Klinika za infektivne i dermatoveneroloske bolesti, Medicinski fakultet, Novi Sad.

The authors review the results of the treatment of venous varices by PEMF, treated at the Dept of Dermatovenereology in Novi Sad and the Institute of Med Rehabilitation. The treatment was carried out in 18 patients: 5 men and 13 women, mean age 56 yr, all with venous varices of post-thrombophlebitic origin. The number of sessions within the PEMF treatment was 10/patient, each session lasting 15 m. The results were followed by measuring the varix surface before and after the treatment. The number of varices before the therapy was 26 and after the treatment was 20. The total surface of the varices before the treatment was 55183.90 mm², the mean surface being 2122.46 mm². After the treatment 6 varices epithelialized, while the total surface was 36902.51 mm². The mean surface of the varices after the treatment was 1845.13 mm². The varix surface reduction rate after the treatment was 33.13%. Considering the number of patients, the obtained results are preliminary and they reflect the benefits of PEMF for epithelialization of venous varices. PMID: 1821449, UI: 92334277

Ieran M, Zaffuto S, Bagnacani M, Annovi M, Moratti A, Cadossi R (1990) Effect of low frequency pulsing EMFs on skin **ulcers of venous origin** in humans: a double-blind study.

J Orthop Res Mar;8(2):276-282. Dept of Med Angiology, Arcispedale S. Maria Nuova, Reggio Emilia, Italy.

The effect of an EMF on the healing of skin ulcers of venous origin in humans has been investigated in a double-blind study. 44 patients have been admitted to the study; one-half were exposed to active stimulators (experimental group) and the remaining to dummy stimulators (control group). The stimulation was scheduled to last a maximum of 90 d. The success rate was significantly higher in the experimental group both at d 90 ($p < .02$) and in the follow-up period ($p < .005$). The effect of the EMF may last even when the stimulation is over. No ulcers worsened in the experimental group, while 4 worsened in the control group. 25% of the patients in the experimental group and 50% in the control group experienced recurrence of the ulcer. **Stimulation with an EMF is a useful adjunctive therapy in the management of these patients.** Publication Types: Clinical trial Controlled clinical trial PMID: 2303961, UI: 90155636

Stiller MJ, Pak GH, Shupack JL, Thaler S, Kenny C, Jondreau L (1992) A portable pulsed EMF (PEMF) device to enhance healing of **recalcitrant venous ulcers**: a double-blind, placebo-controlled clinical trial.

Br J Dermatol Aug;127(2):147-154. Ronald O. Perelman Dept of Dermatology, New York Univ Med Ctr, New York.

A prospective, randomized, double-blind, placebo-controlled multicentre study assessed the clinical efficacy and safety of pulsed EM limb ulcer therapy (PELUT) in the healing of recalcitrant, predominantly venous leg ulcers. The portable device was used at home for 3 h daily during this 8-wk clinical trial as an adjunct to a wound dressing. Wound surface area, ulcer depth and pain intensity were assessed at wk 0, 4 and 8. At wk 8 the active group had a 47.7% decrease in wound surface area vs. a 42.3% increase for placebo ($p < .0002$). 50% of the ulcers in the active group healed or markedly improved vs. 0% in the placebo group, and 0% of the active group worsened vs. 54% of the placebo group ($p < .001$). Significant decreases in wound depth ($p < .04$) and pain intensity ($p < .04$) favouring the active group were seen. Patients whose ulcers improved significantly after 8 wk were permitted to continue double-blind therapy for an additional 4 wk. 11 active and 1 placebo patient continued therapy until wk 12, with the active treatment group continuing to show improvement. There were no reports of adverse events attributable to this device. **The PELUT device was a safe and effective adjunct to non-surgical therapy for recalcitrant venous leg ulcers.** Publication Types: Clinical trial Multicenter study Randomized controlled trial PMID: 1390143, UI: 93002349

Kirillov IB, Suchkova ZV, Lastushkin AV, Sigaev AA, Nekhaeva TI (1996)
[Magnetotherapy in the comprehensive treatment of **vascular complications** of diabetes mellitus - Article in Russian]. Klin Med (Mosk) 74(5):39-41.

320 diabetes mellitus (DM) patients were exposed to impulsive magnetic field, 100 control DM patients received conservative therapy alone. 270 patients had microangiopathy, macroangiopathy was diagnosed in 50 patients. Magnetotherapy in combination with conservative methods gave good and satisfactory results in 74% of patients versus 28% in control group. Metabolism stabilization resulted in some patients in reduced blood sugar. Use of magnetic field produced faster and longer response than conservative therapy.

PMID: 8999182, UI: 97062022

Venous Insufficiency

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 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.

Galimzianov FV (1990) [Electromagnetic therapy after **phlebectomy** - Article in Russian]. Khirurgiia (Mosk) May;5:108-110.

Comparative analysis of outpatient treatment by means of pulsed complexly-modulated EMF (PCMEMF) applied after **phlebectomy** in 30 patients with varicosity of the lower limbs showed the expediency of this type of treatment in the postoperative period. Exposure of the operated on limb to PCMEMF raises the efficacy of the rehabilitation measures and reduces the terms of the patients' temporary incapacity. PMID: 2391917, UI: 90362765

Pasynkov EI, Konstantinova GD, Vlasova EI (1976) [Therapeutic use of alternating magnetic field in **chronic diseases of the veins** of the lower limbs - Article in Russian]. Vopr Kurortol Fizioter Lech Fiz Kult Sep;5:16-19. PMID: 1025854, UI: 77176520

Wound Healing

Nikolova L, Popov A, Klouček E (1984) [Effect of **interference current** and low-frequency magnetic field on **tissue regeneration** - Article in Russian]. Vopr Kurortol Fizioter Lech Fiz Kult May;3:19-23. PMID: 6332416, UI: 84301978

Kucherenko AE, Shevchuk VI (1976) [Treatment of various diseases of the **limb stumps** by alternating magnetic field -
[Article in Russian]. Klin Khir Jul;7:47-49. PMID: 1018446, UI: 77122057

various health problems

Subrahmanyam S, Satyanarayana M, Rajeswari KR (1986) Alcoholism: newer methods of management.

Indian J Physiol Pharmacol Jan;30(1):43-54.

Chronic alcoholics were selected from hospitals and AA Centres and subjected to different methods of treatment namely, psychotherapy, stereotaxic surgery, nonvolitional biofeedback, Yoga and meditation **and extremely low frequency Pulsed Magnetic Field.**

Each group comprised at least 20 subjects. All were males, aged 20-45 yr. Investigations done were clinical, psychological, biochemical, neurochemical and electrophysiological. Improvement was noticed in all the patients, the degree varying with the different methods of treatment. The patients were followed up at least for a period of 1 yr. PMID: 3818032, UI: 87136087

Strelkova NI, Maslovskaia SG, Gavrilkov AG, Strel'tsova EN (1983)

[Use of the EMF in patients after disturbance of cerebral circulation - Article in Russian]. Sov Med 5:35-38.

PMID: 6612459, UI: 83302409

Ozinkovskii VV (1980) [Use of a low-frequency pulsing EMF in treating inflammatory diseases of the ENT organs –

[Article in Russian]. Zh Ushn Nos Gorl Bolezn May;3:51-53.

PMID: 7385978, UI: 80216160

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