# PULSED ELECTROMAGNETIC FIELD (PEMF) MEDICAL RESEARCH

Dr Gordon’s Clinical Experience With Nanosecond PEMF

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Summary points of NASA Study

EM-PROBE Technologies founder, Dr. Glen A. Gordon, MD is a leading researcher in the energy medicine field. During 25 years of sports medicine practice, his direct clinical use of nanosecond PEMF therapy spanned 20,000 patients, including Olympic athletes Thomas McCants, Former World Champion Hurdler, and Calvin Smith, Former Olympic Gold Medalist. Below are some of Dr. Gordon’s clinical observations on specific conditions he has treated, and a collection of medical studies (there are over 3,000) on conditions that PEMF has been found effective for. Note: the PEMF technology employed in the EMpulse device is nanosecond speed, which NASA found to increase healing rates 2.5-4.0 times over older millisecond PEMF technology.

## SPORTS INJURY

### What Athletes are saying about EMpulse

**Calvin Smith, Former Olympic Gold Medalist**

"It is my great pleasure to relate my experience with EMpulse technology. Just prior to the Los Angeles Olympic Games in 1982 I tore a hamstring so badly I thought the Olympics were history before they started. I made arrangements to visit Dr Gordon’s clinic, and underwent treatment with this new EMpulse device. We treated several days, two or three times per day as I recall, but the results I remember very well; they were spectacular. **I’d never seen a hamstring injury recover with such speed.** I was on the 4 X 100 team with Ron Grady, Kirk Baptiste, and Carl Lewis. After finding I could put the nitro to my hamstring I was primed for the 4x100. We smoked the competition and set a new world record at Los Angeles.

[more...](#)

Calvin Smith won Olympic gold for the 100m relay in 1984, and the 100m bronze medal at the 1988 Olympics. He also won 2 individual World Championship gold medals and in 1983 broke the 100 metre World Record at Colorado Springs, Colorado on July 3 with a time of 9.93 seconds.
Thomas McCants, Former World Champion Hurdler

"Just as you and others helped me become a champion in my specialty, I’d like to extend to you my solid endorsement for EMpulse. It provided me a drug free, convenient means to treat muscle pulls, strains and sprains that were such a common part of being a highly competitive athlete. As I consulted with you in my hey-days of the mid 1980s, I know you’ve done your homework in bringing EMpulse to potential users of this healing technology.

I know there were many athletes who benefited from EM-PROBE Technology related devices just as I did. You leveled the playing field for American athletes who had to compete against USSR and East German athletes who had benefited from this technology years ahead of us."

Why Did NASA Study nanosecond PEMF for 4 Years?

- Astronauts in space face danger even from minor injuries like a scratch - infection and inability to heal. Why? They have left the Earth’s magnetic field, an energy source our cells evolved with.
- NASA found healing rates increased 2.5-4.0 times faster than other technology.
- Increases mitochondria (oxidative capacity of tissues) 300-400%.
- EMpulse is the only device on the market with nanosecond speed.

Why EMpulse Is Effective for Sports Injury

Oxidants and antioxidants are "paramagnetic" i.e. capable of being influenced by EM fields. As they move toward each other, EMpulse antioxidant technology guides their reactive surfaces into alignment, opening the door to rapid neutralization of free radical oxidants, thus stopping damage to the body.

- The sooner free radicals are stopped the sooner healing can begin; neither light or electro-stim technologies even come close as demonstrated by the NASA study.
- European athletes have been using PEMF since the 80's for fast recovery.

Improve Sports Performance - Insure Your Competitive Edge

- Dramatically decreases down time and resultant disuse changes in strength, endurance, and proprioception, as demonstrated in medical studies.
Put EMpulse on immediately after injury and be ready to go next morning.

**EMpulse is the most advanced PEMF device on the market**

Dr. Glen Gordon, the founder of EM-PROBE Technology, became the first MD in the US approved by FDA in 1980 to treat humans with pulsed electromagnetic field (PEMF), for treatment of soft tissue injury and arthritis. Dr. Gordon's experience with PEMF application in sports medicine spans 25 years and 20,000 patients.

EMpulse nanosecond technology operates from 1,000 to 1,000,000 times faster than other PEMF devices on the market.

> "When we began research on EMpulse we refined the EMF pulse to nanosecond speed, and healing rates increased dramatically. Believe it or not, this advance was ignored for twenty years. Finally, in 2003, NASA scientists found nanosecond pulses like ours 2.5-4.0 times better than older pulses at restoring tissue after trauma. This is due, among other factors, to nanosecond PEMF's marked ability to stimulate growth hormone." - Dr. Glen Gordon

**What Researchers Are Saying**

In 1982 Dr. Gordon was the first to propose nanosecond speed was a critical for therapeutic PEMF applications. This has now been proven by NASA in the largest study ever done on PEMF.

NASA’s four year study defining speed as the critical pulse factor concluded:
"square waves with rapid dB/dt (nanosecond speed) can be used for "growing tissue for transplantation------ restoring tissue after trauma------and mitigating some neurodegenerative disorders".

They found nanosecond technology "capable of stimulating classes of genes associated with cell growth and restoration in a no way marginal manner".

Standing before Dr Thomas J Goodwin’s poster on genetic effects of nanosecond pulsed electromagnetic fields, Dr Gordon enjoys a cordial moment with the senior NASA scientist who completed this very important study which found nPEMF 2.5-4.0 times better than other electric or electromagnetic technologies at restoring tissue after trauma.

**2005 American College of Sports Medicine**

₁ NASA 4-year collaborative study on the efficacy of electromagnetic fields to stimulate growth and repair in mammalian tissues NASA/TP-2003-212054
ACHILLES TENDONITIS

Arch Phys Med Rehabil. 1997 Apr;78(4):399-404

Pulsed magnetic and electromagnetic fields in experimental achilles tendonitis in the rat: a prospective randomized study.

Lee EW, Maffulli N, Li CK, Chan KM.

Department of Orthopaedics and Traumatology, Chinese University of Hong Kong, Prince of Wales Hospital, Shatin, New Territories, Hong Kong.

Dr Gordon’s Clinical Experience

Few things are harder to treat than Achilles tendonitis, especially if it is chronic. If the collagen has liquefied forming a tendon blister the outcome is much more questionable. *** If someone is trying to promote surgery on your tendon, try EMpulse first. A thorough study of Achilles tendon surgery at the Hospital for Special Surgery in New York found surgery no better than doing nothing.**** Achilles tendon surgery is not a magic bullet in anyone’s hands.

Treatment

Move the EMpulse back and forth over the tendon for 30-60 minutes 1-3 times per day for four days. If you get a response with the first or second treatment then position the EMpulse directly over the area and use it all day or overnight until you are pain free with use. If activity causes a flare-up be certain to apply EMpulse immediately after use.

BURSITIS

Lancet. 1984 Mar 31;1(8379):695-8

Pulsed electromagnetic field therapy of persistent rotator cuff tendinitis. A double-blind controlled assessment.

Binder A, Parr G, Hazleman B, Fitton-Jackson S.

The value of pulsed electromagnetic fields (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 weeks of the study, when the control group received a placebo. In the second 4 weeks, 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 weeks. 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.

MUSCLE LOSS


Tardy effect of neurogenic muscular atrophy by magnetic stimulation.

Chang CW, Lien IN.

Department of Physical Medicine and Rehabilitation, National Taiwan University School of Medicine, Taipei, Republic of China.
The influence of pulsed magnetic stimulation on denervated muscles was investigated in this study. Of 24 rats divided into three groups for experiment, 8 rats served as control; 16 rats with bilaterally severed sciatic nerves were divided into two groups for different modes of stimulation. Magnetic stimulation with a high power output that induced an intensive contraction of muscle was applied at one side-denervated gastrocnemius muscle for 1 mo in a group of rats; electric stimulation with high intensity at 6 Hz frequency and 1-ms pulse duration served as a contrast in the other group. Muscular weight, volume, fiber diameter and percentage of fiber types were measured after the experiment. A significant retardation of weight loss in denervated muscles via magnetic stimulation (P < 0.05) was confirmed by observed results. Type II fiber atrophy was retarded in denervated muscles by magnetic stimulation as well as in denervated muscles via electric stimulation. Magnetic stimulation, used as a method that induces muscular activity, was verified in this study as being capable of retarding denervated muscular atrophy. Its benefits of painless stimulation as well as deeply activated muscular contraction could be expected to function as a new model for rehabilitation of paralyzed muscles.

NECK PAIN


Pulsed magnetic field therapy for osteoarthritis of the knee--a double-blind sham-controlled trial.


Department of Physical Medicine and Rehabilitation, AKH Wien, University of Vienna, Vienna, Austria. Peter.nicolakis@akh-wien.ac.at

BACKGROUND AND METHODS: Pulsed magnetic field therapy is frequently used to treat the symptoms of osteoarthritis, although its efficacy has not been proven. We conducted a randomized, double-blind comparison of pulsed magnetic field and sham therapy in patients with symptomatic osteoarthritis of the knee. Patients were assigned to receive 84 sessions, each with a duration of 30 minutes, of either pulsed magnetic field or sham treatment. Patients administered the treatment on their own at home, twice a day for six weeks.

RESULTS: According to a sample size estimation, 36 consecutive patients were enrolled. 34 patients completed the study, two of whom had to be excluded from the statistical analysis, as they had not applied the PMF sufficiently. Thus, 15 verum and 17 sham-treated patients were enrolled in the statistical analysis. After six weeks of treatment the WOMAC Osteoarthritis Index was reduced in the pulsed magnetic field-group from 84.1 (+/- 45.1) to 49.7 (+/- 31.6), and from 73.7 (+/- 43.3) to 66.9 (+/- 52.9) in the sham-treated group (p = 0.03). The following secondary parameters improved in the pulsed magnetic field group more than they did in the sham group: gait speed at fast walking [+6.0 meters per minute (1.6 to 10.4) vs. -3.2 (-8.5 to 2.2)], stride length at fast walking [+6.9 cm (0.2 to 13.7) vs. -2.9 (-8.8 to 2.9)], and acceleration time in the isokinetic dynamometry strength tests [-7.0% (-15.2 to 1.3) vs. 10.1% (-0.3 to 20.6)].

CONCLUSION: In patients with symptomatic osteoarthritis of the knee, PMF treatment can reduce impairment in activities of daily life and improve knee function.

Dr Gordon’s Clinical Experience

The knee and neck are considered here since osteoarthritis is common to both. This is one of dozens of scientific articles showing that PEMF technology is highly effective and free of side effects in treating arthritis. We have more people using EMpulse for arthritis than any other condition, and they would never go back to drugs.

Treatment
Move EMpulse back and forth over area until the most painful area is obvious. Treat those areas by placing the device over them when sleeping, resting or watching TV. You can’t overtreat with side effect free EMpulse. Initially, you should use EMpulse for 30-60 minutes 1-3 times per day for at least four days.

NON-UNIONS

Treatment of ununited tibial fractures: a comparison of surgery and pulsed electromagnetic fields (PEMF).

Gossling HR, Bernstein RA, Abbott J.

Department of Orthopedic Surgery, University of Connecticut Health Center, Farmington 06032.

The use of pulsed electromagnetic fields (PEMF) is gaining acceptance for the treatment of ununited fractures. The results of 44 articles published in the English language literature have been compiled to assess the effectiveness of PEMF vs surgical therapy. For ununited tibial fractures, 81% of reported cases healed with PEMF vs 82% with surgery. After multiple failed surgeries, the success rate of PEMF is reported to be greater than with surgery; this discrepancy increases with additional numbers of prior surgeries. In infected nonunions, the results of surgical treatment decreased by 21% and were less than the results utilizing PEMF (69% vs 81%). In open fractures, surgical healing exceeded PEMF (89% vs 78%), whereas in closed injuries PEMF cases healed more frequently (85% vs 79%). In general, PEMF treatment of ununited fractures has proved to be more successful than noninvasive traditional management and at least as effective as surgical therapies. Given the costs and potential dangers of surgery, PEMF should be considered an effective alternative. Experience supports its role as a successful method of treatment for ununited fractures of the tibia.

Dr Gordon’s Clinical Experience

Both acute fractures and chronic non-unions benefit dramatically from EMpulse technology. This study shows that PEMF is superior to surgery in terms of results when considering cost, side effects etc. Remember also, the PEMF unit they used cost $5000 or more dollars.

Treatment

Tape or place in a sleeve over the cast and treat the fracture site. In acute fracture expect healing in half the time, and healing for the first time in the non-union. Incidentally, even with old technology, the oldest non-union to respond with healing was 12 years old when treatment started.

OSTEOARTHRITIS


Trock DH, Bollet AJ, Markoll R.

Department of Medicine, Danbury Hospital, CT.
OBJECTIVE. We conducted a randomized, double blind clinical trial to determine the effectiveness of pulsed electromagnetic fields (PEMF) in the treatment of osteoarthritis (OA) of the knee and cervical spine. METHODS. A controlled trial of 18 half-hour active or placebo treatments was conducted in 86 patients with OA of the knee and 81 patients with OA of the cervical spine, in which pain was evaluated using a 10 cm visual analog scale, activities of daily living using a series of questions (answered by the patient as never, sometimes, most of the time, or always), pain on passive motion (recorded as none, slight, moderate, or severe), and joint tenderness (recorded using a modified Ritchie scale). Global evaluations of improvement were made by the patient and examining physician. Evaluations were made at baseline, midway, end of treatment, and one month after completion of treatment. RESULTS. Matched pair t tests showed extremely significant changes from baseline for the treated patients in both knee and cervical spine studies at the end of treatment and the one month followup observations, whereas the changes in the placebo patients showed lesser degrees of significance at the end of treatment, and had lost significance for most variables at the one month followup. Means of the treated group of patients with OA of the knee showed greater improvement from baseline values than the placebo group by the end of treatment and at the one month followup observation. Using the 2-tailed t test, at the end of treatment the differences in the means of the 2 groups reached statistical significance for pain, pain on motion, and both the patient overall assessment and the physician global assessment. The means of the treated patients with OA of the cervical spine showed greater improvement from baseline than the placebo group for most variables at the end of treatment and one month followup observations; these differences reached statistical significance at one or more observation points for pain, pain on motion, and tenderness. CONCLUSION: PEMF has therapeutic benefit in painful OA of the knee or cervical spine.

Modification of osteoarthritis by pulsed electromagnetic field--a morphological study.

Ciombor DM, Aaron RK, Wang S, Simon B.

Department of Orthopaedics, Brown Medical School, Providence, RI 02906, USA.

OBJECTIVE: Hartley guinea pigs spontaneously develop arthritis that bears morphological, biochemical, and immunohistochemical similarities to human osteoarthritis. It is characterized by the appearance of superficial fibrillation by 12 months of age and severe cartilage lesions and eburnation by 18 months of age. This study examines the effect of treatment with a pulsed electromagnetic field (PEMF) upon the morphological progression of osteoarthritis in this animal model. DESIGN: Hartley guinea pigs were exposed to a specific PEMF for 1h/day for 6 months, beginning at 12 months of age. Control animals were treated identically, but without PEMF exposure. Tibial articular cartilage was examined with histological/histochemical grading of the severity of arthritis, by immunohistochemistry for cartilage neoeptopes, 3B3(-) and BC-13, reflecting enzymatic cleavage of aggrecan, and by immunoreactivity to collagenase (MMP-13) and stromelysin (MMP-3). Immunoreactivity to TGFbeta, interleukin (IL)-1beta, and IL receptor antagonist protein (IRAP) antibodies was examined to suggest possible mechanisms of PEMF activity. RESULTS: PEMF treatment preserves the morphology of articular cartilage and retards the development of osteoarthritic lesions. This observation is supported by a reduction in the cartilage neoeptopes, 3B3(-) and BC-13, and suppression of the matrix-degrading enzymes, collagenase and stromelysin. Cells immunopositive to IL-1 are decreased in number, while IRAP-positive cells are increased in response to treatment. PEMF treatment markedly increases the number of cells immunopositive to TGFbeta. CONCLUSIONS: Treatment with PEMF appears to be disease-modifying in this model of osteoarthritis. Since TGFbeta is believed to upregulate gene expression for aggrecan, downregulate matrix metalloprotease and IL-1 activity, and upregulate inhibitors of matrix metalloprotease, the stimulation of TGFbeta may be a mechanism through which PEMF favorably affects cartilage homeostasis.
Dr Gordon’s Clinical Experience

The Univ of Vienna is one of the best in Europe and this study is one of hundreds demonstrating superior results with EMpulse technology. You may wish to review Dr Ciombor’s article under large and small joint arthritis also. She was the first in the world to report that EMpulse technology actually stopped the arthritic process.

Treatment

Arthritis treatment must be individualized to achieve the best result. Some find moving EMpulse back and forth over the area works best, others can place EMpulse in one spot and that works best for them. Starting out we recommend 30-60 minutes 1-3 times per day for four days minimum. That should help you define the most tender area and where you get best response.

OSTEOPOROSIS

J Bone Miner Res. 1990 May;5(5):437-42.  
Bone density changes in osteoporosis-prone women exposed to pulsed electromagnetic fields (PEMFs).

Tabrah F, Hoffmeier M, Gilbert F Jr, Batkin S, Bassett CA.

University of Hawaii School of Medicine, Straub Clinic and Hospital, Honolulu.

To determine the effect of a 72 Hz pulsating electromagnetic field (PEMF) on bone density of the radii of osteoporosis-prone women, the nondominant forearms of 20 subjects were exposed to PEMF 10 h daily for a period of 12 weeks. Bone density before, during, and after the exposure period was determined by use of a Norland-Cameron bone mineral analyzer. Bone mineral densities of the treated radii measured by single-photon densitometry increased significantly in the immediate area of the field during the exposure period and decreased during the following 36 weeks. A similar but weaker response occurred in the opposite arm, suggesting a "cross-talk" effect on the nontreated radii, from either possible arm proximity during sleep or very weak general field effects. The data suggest that properly applied PEMFs, if scaled for whole-body use, may have clinical application in the prevention and treatment of osteoporosis.

SMALL/LARGE JOINT ARTHRITIS

Modification of osteoarthritis by pulsed electromagnetic field—a morphological study.

Ciombor DM, Aaron RK, Wang S, Simon B.

Department of Orthopaedics, Brown Medical School, Providence, RI 02906, USA.

OBJECTIVE: Hartley guinea pigs spontaneously develop arthritis that bears morphological, biochemical, and immunohistochemical similarities to human osteoarthritis. It is characterized by the appearance of superficial fibrillation by 12 months of age and severe cartilage lesions and eburnation by 18 months of age. This study examines the effect of treatment with a pulsed electromagnetic field (PEMF) upon the morphological progression of osteoarthritis in this animal model. DESIGN: Hartley guinea pigs were exposed to a specific PEMF for 1h/day for 6 months, beginning at 12 months of age. Control animals were treated identically, but without PEMF exposure. Tibial articular cartilage was examined with histological/histochemical grading of the severity of arthritis, by immunohistochemistry for cartilage neoepitopes, 3B3(-) and BC-13, reflecting enzymatic cleavage of aggrecan, and by immunoreactivity to
collagenase (MMP-13) and stromelysin (MMP-3). Immunoreactivity to TGFbeta, interleukin (IL)-1beta, and 1L receptor antagonist protein (IRAP) antibodies was examined to suggest possible mechanisms of PEMF activity. RESULTS: PEMF treatment preserves the morphology of articular cartilage and retards the development of osteoarthritic lesions. This observation is supported by a reduction in the cartilage neoepitopes, 3B3(-) and BC-13, and suppression of the matrix-degrading enzymes, collagenase and stromelysin. Cells immunopositive to IL-1 are decreased in number, while IRAP-positive cells are increased in response to treatment. PEMF treatment markedly increases the number of cells immunopositive to TGFbeta.

CONCLUSIONS: Treatment with PEMF appears to be disease-modifying in this model of osteoarthritis. Since TGFbeta is believed to upregulate gene expression for aggrecan, downregulate matrix metalloprotease and IL-1 activity, and upregulate inhibitors of matrix metalloprotease, the stimulation of TGFbeta may be a mechanism through which PEMF favorably affects cartilage homeostasis.

WHIPLASH


Low energy high frequency pulsed electromagnetic therapy for acute whiplash injuries. A double blind randomized controlled study.

Foley-Nolan D, Moore K, Codd M, Barry C, O’Connor P, Coughlan RJ.

Mater Misericordiae Hospital, Dublin, Ireland.

The standard treatment of acute whiplash injuries (soft collar and analgesia) is frequently unsuccessful. Pulsed electromagnetic therapy PEMT (as pulsed 27 MHz) has been shown to have pro-healing and anti-inflammatory effects. This study examines the effect of PEMT on the acute whiplash syndrome. One half of the 40 patients entering the study received active PEMT collars: the other half facsimile (placebo). All patients were given instructions to wear the collar for eight hours a day at home and advised to mobilise their necks. At 2 and 4 weeks the actively treated group had significantly improved (p less than 0.05) in terms of pain (visual analogue scale). By chance movement scores for the PEMT group were significantly worse at entry to the study than the control group (p less than 0.05). At 12 weeks they had become significantly better (p less than 0.05). PEMT as described is safe for domiciliary use and this study suggests that PEMT has a beneficial effect in the management of the acute whiplash injury.

Dr Gordon’s Clinical Experience

This article appears in an excellent journal and from an excellent institution. The frequency in EMpulse is much lower than used in this article, and is generally preferred by scientists treating injuries such as whiplash. We had good results with whiplash, especially when treated early.

Treatment

Move EMpulse slowly over head, neck, shoulders, and back for the first several days until the more resistant areas are defined. Concentrate on these over the next three weeks by placing EMpulse over the site and resting against it in a chair or while in bed. The EM-PROBE theratowel is a good means of securing EMpulse over the painful areas. Speak with your provider about rhythmic, easy movement, as tolerated early in the injury.
**NASA 4-year collaborative study on the efficacy of electromagnetic fields to stimulate growth and repair in mammalian tissues NASA/TP-2003-212054***

**CHIEF INVESTIGATORS:**
Robert Dennis Ph.D. - University of Michigan
Thomas J Goodwin Ph.D. Lynden B Johnson Space Center

**PURPOSE:**
This four year study used human donors "to define the most effective electromagnetic fields for enhancing growth and repair in mammalian tissues."

To utilize "nerve tissue which has been refractory to efforts to stimulate growth or enhance its repair regardless of the energy used." (all other tissues have demonstrated growth and repair stimulation with appropriate PEMF)

To define a PEMF technology that would "duplicate mature, three dimensional morphology between neuronal cells and feeder (glial) cells, which has not been previously accomplished."

**RESULTS:**
The PEMF used in the study "caused accelerated growth rate and better organized morphology over controls", and resulted in "greater cell viability" (85% vs. 65%).

In the gene discovery array (chip technology that surveyed 10,000 human genes), the investigators found up-regulation of 150 genes associated with growth and cell restoration. T. Goodwin (personal communication) " PEMF shut down each dysregulatory gene we studied".

**NASAs CONCLUSION:**
"The up-regulation of these genes is in no manner marginal (1.7-8.4 logs) with gene sites for collagen production and growth the most actively stimulated."

"We have clearly demonstrated the bioelectric/biochemical potentiation of nerve stimulation and restoration in humans as a documented reality".

"The most effective electromagnetic field for repair of trauma was square wave with a rapid rate of change (dB/dt) which saw cell growth increased up to 4.0 times."

They further noted that "slowly varying (millisecond pulse, sine wave) or non varying DC (CW lasers, magnets) had little to no effect."

Final Recommendation: "One may use square wave EM fields with rapid rate of change for":

- repairing traumatized tissues
- moderating some neurodegenerative diseases
- developing tissues for transplantation

*the first study to clarify technologies and efficacy parameters for tissue growth and restoration

For brevity we reduced the 33 page technical paper to the above summary which we feel represents the essence of that communication. For those who wish to review the molecular and genetic portion of the report click on the following: