The Use of Pulsed Electromagnetic Fields (PEMF) in Osteoarthritis (OA) of the Knee Preliminary Report

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Magnets are widely used by arthritic patients for symptom control.[1] Clinical benefits have been reported from the intermittent application of pulsed electromagnetic fields to osteoarthritic joints.[2,3] However, published trials have used complex electromagnetic fields generated by cumbersome expensive equipment, limiting true portability and widespread use. We report comparable beneficial effects using a continuous sine wave input to Helmholz coils run on standard household electricity.

Fifteen patients with osteoarthritis of at least one knee as defined by Altman[4] were drawn from the outpatient Adult Rheumatology practice of one of the authors (TDC). Patients had to be older than 18 years and symptomatic in the subject knee for at least one year. Pain had to be incompletely relieved by analgesics, nonsteroidal antiinflammatory drugs (NSAIDs) and physical therapy. No new treatments (intra-articular injection into the subject joint, PT, NSAIDs) were allowed within a month of, and during the study. Stable regimes were continued. Pregnant and premenopausal women not using contraception were excluded, as were patients with pacemakers or medical problems judged unstable.

Subjects applied the supplied magnet to the designated knee for three hours daily for thirty days. They then returned to the clinic for reevaluation, and to receive the second magnet, which was then similarly applied at home.

Of the pairs of magnets sequentially used by each patient, one magnet (hereinafter referred to as the "active magnet") consisted of Helmholz coils delivering a 0.4 milliTesla, peak to peak, electromagnetic field at 60 Hz, in a sine wave configuration (Fig 1.). The other magnet appeared identical in all respects, but the fields affecting the joint were the earth's magnetic field only, plus whatever stray fields the individual might encounter in daily life ("inactive magnet"). Subjects were assigned randomly to receive either magnet first.

Figure 1.— Clinical variables at baseline, after one month of active magnet treatment and after one month of inactive magnet treatment.

	Baseline	Active Magnet	Inactive Magnet
Pain VAS	4.3	2.4	3.1
Function VAS (Pt)	4.3	6.7	4.8
Function VAS (MD)	5.1	6.7	5.2
Morning Stiffness (minutes)	33.5	6.0	21.5
Loss of ROM (degrees)	5.4	2.0	5.2
Tenderness (0-3)	0.8	0.4	1.2
Swelling (0-3)	1.1	0.9	0.9
Circumference (cm)	39.4	40.3	40.3
50 ft walk time (sec)	15.0	14.3	15.6

Abbreviations used in table: VAS – visual analog scale; Pt – patient assessment; MD – physician assessment; ROM – range of motion.

The following data were collected at baseline, at 30 days (end of treatment period with the first magnet), and at 60 days (end of treatment period with the second magnet); patient's assessment of pain, and the patient's assessment of function on a ten centimeter visual analog scale (VAS), minutes of morning stiffness of the subject knee, range of motion, tenderness on an ordinal scale of 0 to 4 (0 = no tenderness, 4 = withdrawal), swelling on an ordinal scale of 0 to 4, knee circumference in cm, and time in seconds for the patient to walk 50 feet. Neither the assessing physician nor the patient knew which magnets were active or not.

Of the fifteen patients enrolled and randomized, there were four early withdrawals from the group that received the inactive magnet—one at three days and two at one week for lack of patient-

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creation of the NCCAM. JABSOM believes that it can be a leader in the United States, and internationally in the credible scientific study of alternative and complementary therapies. Furthermore, JABSOM believes that it is important to educate medical students about the therapies that their patients are using which may augment or detract from conventional allopathic medicine. For these reasons, we believe it is important to start a Department of Integrative Medicine at the John A. Burns School of Medicine.

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perceived effect. Another withdrawal was for travel. Ten patients completed the study.

Results obtained for the monitored parameters are summarized in Table 1. Thirty days of active magnet use improved pain, perception of function, and the range of motion of the joint, while reducing the duration of morning stiffness in the knee, and increasing the range of motion. No effect was noted on joint swelling, circumference, or time needed to walk 50 feet.

Cartilage, like bone, has piezoelectric properties leading to electrical outputs thought to be capable of stimulating chondrocyte synthesis of matrix components.[5] Similar electrical changes may occur through Faraday induction from applied time-varying electromagnetic fields. Complex chemical responses are detectable within 48 hours of PEMF exposure.[6-8]

Although pain, morning stiffness, and range of motion appear to be beneficially affected by the active field used in this study, further sampling with appropriate statistical evaluation is necessary for valid quantitative conclusions. Extended studies should be designed to histologically determine whether PEMF exposure has true chondroprotective or repair potential in the intact joint, or both.

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