



Fig. 1. Percent improvement, defined as difference between baseline value and value at each specific observation point, divided by baseline value (times 100). Numbered observations shown included (1) Overall severity of pain. (2) Difficulty performing ADL identified as the most troublesome by the patient before therapy was begun. (3) Pain generated by the most troublesome ADL. (4) The worst discomfort experienced in affected joint area in the past week. (5) Pain on motion of the treated joint detected by the examining physician. (6) Tenderness of study joint detected by the examining physician. 1A: Treated patients; 1B: Placebo patients.

Table 3. Assessment of improvement by observing physician at midpoint of treatment, end of treatment and one month after completion of treatment. *p* Value is for difference between treated and placebo groups

	Midpoint	End of Treatment	1 mo Later
Treated patients			
Mean	2.71	2.71	3.30
SEM (\pm)	0.27	0.37	0.45
Placebo patients			
Mean	1.73	1.86	1.75
SEM (\pm)	0.27	0.47	0.34
<i>p</i> =	0.0175	0.1611	0.0134

made on these patients. As a group, these patients showed improvement during the active treatment phase but, in view of the small numbers involved, statistically significant changes that occurred did not occur in all of the variables followed.

Radiographs were graded as to severity of the OA. There were too few cases in the treated group to permit meaningful statistical analysis of the response according to radiological criteria of severity. It is possible to say, however, that 5 patients with radiologic grade 3 and 4 disease obtained good or excellent responses according to physician assessment at the last observation, and thus that advanced disease does not preclude symptomatic benefit from this form of therapy.

DISCUSSION

The results of our prospective double blind study of PEMF treatment show beneficial effects in the amelioration of symptoms, subjective improvement in functional ability and decrease in objective findings in a small group of patients

with OA. The benefit seemed to continue for at least the first month after completion of treatment. Furthermore, no toxicity was observed.

This application of PEMF therapy is not similar to other physical modalities of treatment, such as ultrasound, TENS, diathermy, moxibustion, etc. The PEMF generated by the device used in our study differs from the device used in the treatment of unhealed fractures in that it generates a lower frequency (<30 Hz vs 72 Hz), as well as differing in pulse and wave form characteristics. The extremely low frequency pulsed magnetic fields used in these studies, as well as those used in laboratory experiments, are too weak to work through a mechanism such as thermal effect, dielectric breakdown, particle displacement or electrophoresis. Mechanisms which have been suggested include some form of induced resonance of outer shell electrons, an effect on cell membrane receptors or on other endogenous processes, such as an effect on ion flux, but these suggested mechanisms lack experimental substantiation¹⁵⁻¹⁸. Evidence exists that pulsed magnetic fields can modulate the actions of hormones, antibodies, and neurotransmitters at surface receptor sites of a variety of cell types¹⁵. Effects on fibroblast, chondrocyte and osteocyte metabolism and lymphocyte functions have been reported. Augmentation of mRNA and protein synthesis has been reported in several tissue culture systems^{16,17,19-25}.

Since the factors responsible for the pain in patients with OA are varied and often uncertain in an individual patient, an attempt to delineate the mechanism of pain relief brought about by this form of therapy in relation to known biological effects of pulsed magnetic fields would be purely speculative.

This form of nonionizing radiation is not known to have

any deleterious clinical effects, despite the variety of metabolic changes that have been demonstrated in laboratory experiments. On the basis of the findings in this pilot study, further investigation of clinical effects of pulsed magnetic fields in OA is warranted.

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