

Pulsed Electromagnetic Field Therapy (PEMF)

Pulsed electromagnetic field therapy (PEMF) is quite distinct from magnet therapy itself. (The term “electromagnetic field” does not, in this case, refer to magnetism in the ordinary sense.) Nonetheless, for historical reasons, it is often classified together with true magnetic therapies. Because of that, we discuss it here.

Bone has a remarkable capacity to heal from injury. In some cases, though, the broken ends do not join, called non-union fractures. PEMF therapy has been used to stimulate bone repair in non-union and other fractures since the 1970s; this is a relatively accepted use and will not be discussed here. More controversially, PEMF has shown promise for osteoarthritis, stress incontinence, and possibly other conditions as well.

Osteoarthritis

Three double-blind, placebo-controlled studies enrolling a total of more than 350 people suggest that pulsed electromagnetic field therapy can improve symptoms of [osteoarthritis](#) . [11,12,47](#)

For example, a double-blind, placebo-controlled study tested PEMF in 86 people with osteoarthritis of the knee and 81 with osteoarthritis of the cervical spine. [12](#) Participants received 18 half-hour sessions with either a PEMF machine or a sham device. The treated participants showed significantly greater improvements in disease severity than those given placebo. For both osteoarthritis conditions, benefits lasted for at least 1 month after treatment was stopped.

A more recent double-blind trial evaluated low-power, extremely low-frequency pulsed electromagnetic fields for the treatment of knee osteoarthritis. [38](#) A total of 176 people received eight sessions of either sham or real treatment over a period of 2 weeks. The results showed significantly greater pain reduction in the treated group.

Urinary Incontinence

Many women experience stress incontinence, the leakage of urine following any action that puts pressure on the bladder. Laughter, physical exercise, and coughing can all trigger this unpleasant occurrence. A recent study suggests that PEMF treatment might be helpful. In this placebo-controlled study, researchers applied high-intensity pulsating magnetic fields to 62 women with stress incontinence. [14](#) The intention was to stimulate the nerves that control the pelvic muscles.

The results showed that one session of magnetic stimulation significantly reduced episodes of urinary leakage over the following week, compared to placebo. In the treated group, 74% experienced significant improvement, compared to only 32% in the placebo group. Presumably, the high-intensity magnetic field used in this treatment created electrical currents in the pelvic muscles and nerves. This was confirmed by objective examination of 13 patients, which found that magnetic stimulation was in fact increasing the strength of closure at the exit from the bladder. However, there was one serious flaw in this study: it does not appear to have been double-blind. (For more information on why this is important, see [Why Does This Database Rely on Double-blind Studies?](#)) Researchers apparently knew which participants were getting real treatment and which were not, and therefore might have unconsciously biased their observations to conform to their expectations. Thus, the promise of electromagnetic therapy for stress incontinence still needs to be validated in properly designed trials.

Similarly, magnetic stimulation has been studied for the treatment of bed-wetting (nocturnal enuresis). In a small preliminary study, the use of PEMF day and night for 2 months was helpful in girls. [88](#)

Multiple Sclerosis

A 2-month, double-blind, placebo-controlled study of 30 people with [multiple sclerosis](#) was conducted using a PEMF device. [13](#) Participants were instructed to tape the device to one of three different acupuncture points on the shoulder, back, or hip. The study found statistically significant improvements in the treatment group, most notably in bladder control, hand function, and muscle spasticity. Benefits were seen in another small study too. [58](#)

Erectile Dysfunction

In a 3-week, double-blind, placebo-controlled trial, 20 men with [erectile dysfunction](#) received PEMF therapy or placebo. [30](#) The magnetic therapy was administered by means of a small box worn near the genital area and kept in place as continuously as possible over the study period; neither participants nor observers knew whether the device was actually activated or not. The results showed that use of PEMF significantly improved sexual function compared to placebo.

Migraines

In a double-blind trial, 42 people with [migraine headaches](#) were given treatment with real or placebo pulsed electromagnetic therapy to the inner thighs for 1 hour, 5 times per week for 2 weeks. [15](#) The results showed benefits in headache frequency and severity. However, the study design was rather convoluted and nonstandard, and, therefore, the results are difficult to interpret.

Postoperative Pain

In a small, randomized trial, 80 women undergoing breast augmentation surgery were divided into three groups. The first group received PEMF therapy for 7 days postsurgically to both breasts, the second group received fake PEMF therapy to both breasts as a control, and the third group received real and fake PEMF therapy to either breast. Compared to the control, women receiving PEMF therapy reported significantly less discomfort and used less pain medications by the third postoperative day. [82](#)

Electromagnetic Therapy: Repetitive Transcranial Magnetic Stimulation

Unlike PEMF, repetitive transcranial magnetic stimulation (rTMS) does in fact involve magnetic fields, and is, therefore, more closely related to standard magnet therapy. It involves applying low-frequency magnetic pulses to the brain. rTMS has been investigated for treating emotional illnesses and other conditions that originate in the brain. The results of preliminary studies have been generally promising.

Depression

About 20 small studies have evaluated rTMS for the treatment of [depression](#) (including severe depression that does not respond to standard treatment, as well as the depressive phase of [bipolar illness](#)), and most found it effective. [16-24,39,41,48-50,59-62,99](#)

In one of these studies, 70 people with major depression were given rTMS or sham rTMS in a double-blind setting over a period of 2 weeks. [17](#) The results showed that participants who had received actual treatment experienced significantly greater improvement than did those receiving sham treatment. In a far larger study involving 301 depressed patients, none of whom were being treated with antidepressant medications, real rTMS was significantly more effective than fake rTMS after 4-6 weeks of treatment. [89](#)

In a much smaller trial involving 45 subjects, researchers found that rTMS is more effective than sham rTMS as an add-on treatment to medication in people with moderate to severe depression (including those with psychotic symptoms). [99](#)

In another trial involving 92 older patients whose depression had been linked to poor blood flow to the brain (so-called vascular depression), actual rTMS was significantly more effective than sham rTMS. Benefits were more notable in younger patients. [79](#)

In a particularly persuasive piece of evidence, researchers pooled the results of 30 double-blind trials involving 1,164 depressed patients and determined that real rTMS is significantly more effective than sham (fake) rTMS. [81](#)

Two separate studies suggest that rTMS may be an effective additional treatment for the 20%-30% of depressed people for whom conventional drug therapy is not successful. [25,80](#) Another group of researchers pooled the results of 24 studies involving 1,092 patients and found rTMS to be more effective than sham for treatment resistant depression. [86](#) ECT (electroconvulsive therapy, or shock treatment) is often used for people who fall in this category, but rTMS may be an equally effective alternative. [22,24,49](#)

Epilepsy

In a double-blind, placebo-controlled trial, 24 people with [epilepsy](#) (technically, partial complex seizures or secondarily generalized seizures) not fully responsive to drug treatment were given treatment with rTMS or sham rTMS twice daily for a week. [8](#) The results showed a mild reduction in seizures among the people given real rTMS. However, the benefits rapidly disappeared when treatment was stopped. Similarly short-lived effects were seen in an open trial. [26](#)

Schizophrenia

A double-blind, placebo-controlled crossover trial looked at the use of low-frequency rTMS in 12 people diagnosed with [schizophrenia](#) and manifesting frequent and treatment-resistant auditory hallucinations (hearing voices). [27](#) Participants received rTMS for 4 days, with length of treatment building from 4 minutes on the first day to 16 minutes on the fourth day. Active stimulation significantly reduced the incidence of auditory hallucinations compared to sham stimulation. The extent of the benefit varied widely, lasting from 1 day in one participant to 2 months in another. Possible benefits were seen in other small studies, as well. [28,63](#) Researchers pooling the results of 6 controlled trials, which involved a total of 232 patients with schizophrenia resistant to conventional treatment, found that real low-frequency rTMS was significantly better at reducing auditory hallucinations compared to sham rTMS. [87](#)

Parkinson's Disease

In a double-blind, placebo-controlled trial of 99 people with [Parkinson's disease](#), real rTMS was more effective than sham (fake) rTMS delivered over 8 weekly treatments. [83](#) Similar benefits were seen in 3 other small studies, as well. [40,64,71](#) Even more encouraging, the combined results of 10 randomized trials in Parkinson's patients indicated significant benefit for rTMS (using higher frequencies). [90](#) However, a subsequent small, randomized study involving 23 people did not find promising results. [102](#) Compared to placebo, 10 days of transcranial electrostimulation did not improve the symptoms of Parkinson's disease.

Chronic Pain Syndromes

rTMS technology has also been applied to areas other than the brain. Myofascial pain syndrome is a condition similar to [fibromyalgia](#), but more localized. While fibromyalgia involves tender trigger points all over the body, myofascial pain syndrome involves trigger points clustered in one portion of the body only. One controlled trial found indications that a form of repetitive magnetic stimulation applied to the painful area may be effective for myofascial pain syndrome of the trapezius muscle. [65](#)

In a placebo-controlled trial involving 61 people with long-standing diabetes, low-frequency repetitive magnetic stimulation failed to diminish the pain associated with [diabetic peripheral neuropathy](#) . [84](#) Interestingly, however, in another study involving 28 people with peripheral neuropathy, high frequency rTMS applied to the brain was more effective at reducing pain and improving quality of life than fake rTMS. [92](#)

Tinnitus

A preliminary study found indications that rTMS may be helpful for [tinnitus](#) (ringing in the ear). [66](#) However, a subsequent review of 5 randomized trials comparing rTMS to sham rTMS in 233 people with tinnitus found limited evidence to support its use for this condition. [101](#) The authors highlighted the need for more studies with larger sample sizes.

Post-traumatic Stress Disorder

A small, double-blind, placebo-controlled study found that use of rTMS may be able to reduce symptoms of post-traumatic stress disorder. [67](#)

Cigarette Addiction

A very small, double-blind, placebo-controlled study found evidence that rTMS may reduce craving for cigarettes in people attempting to [quit smoking](#) . [68](#)

Obsessive-compulsive Disorder

A double-blind, placebo-controlled study of 18 people with [obsessive-compulsive disorder](#) found no evidence of benefit with rTMS. [29](#)

Myotrophic Lateral Sclerosis (Lou Gerhig's Disease)

Amyotrophic lateral sclerosis (ALS) is a nerve disorder that causes progressive muscle weakness. A small pilot study hinted that rTMS may be beneficial at least temporarily. [78](#)

Chronic Regional Pain Syndrome

People with chronic regional pain syndrome (CRPS) may have a feeling of aching or burning in their arms or legs. One small study included 23 people with CRPS who were already getting conventional treatment (eg, pain medication, physical therapy) for pain in their arms. [98](#) The groups were randomized to receive either real or sham rTMS for 10 daily sessions. Those who received the real magnet therapy experienced a significant reduction in pain during the 10 days of treatment, but the effect did not persist.

Stroke

Twenty people, recovering from a stroke in a rehabilitation program, were randomized to receive transcranial direct current stimulation (tDCS) or sham treatment. [96](#) Both groups also received physical and occupational therapy. Those in the tDCS group experienced a greater improvement in their motor function, suggesting that this form of magnet therapy may be a beneficial addition to an overall rehab program.

Fibromyalgia

tDCS has also been studied as a possible treatment for fibromyalgia. A small randomized trial involving 30 adults with fibromyalgia found that tDCS delivered to the eyebrow area may help reduce pain compared to fake tDCS treatment or real tDCS delivered to other areas of the head. [100](#) In another study, 91 people with fibromyalgia were randomized to receive electrostimulation to the motor cortex in the brain or sham therapy. [103](#) Those in the treatment group experienced a modest improvement in their symptoms compared to the sham group.

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