

How PEMF Therapy Works

Many benefits of Pulsed Electro-Magnetic Field ("PEMF") therapy have been demonstrated through more than 2,000 University level double-blind medical studies done in many countries with many different PEMF therapy devices. Some of the positive effects of PEMF therapy were well established by the mid 1900's. The first commercially produced low power PEMF devices entered the market in the early 1900s. These were used for studies and experimentation in healing and cellular wellness. They were sold to both consumers and as medical devices to doctors. The first commercially produced high power PEMF devices entered the market around 1975. They focused on muscle, nerve, tendon, ligament and cartilage health, on reducing pain and on regeneration.

Medical PEMF therapy has been accepted in many countries around the world. The US FDA accepted the use of PEMF devices in the healing of non-union bone fractures in 1979, urinary incontinence and muscle stimulation in 1998, and depression and anxiety in 2006. Israel has accepted the use of PEMF devices in for migraine headaches. Canada has accepted PEMF devices for several uses. The European Union has many acceptances for the use of PEMF therapy in many areas including healing and recovery from trauma, degeneration and the treatment of the pain associated with these conditions.

Differences in PEMF Therapy Devices

• Power Level

The magnetic energy produced by the various PEMF devices can be as little as that of the Earth's magnetic field to more than 10,000 times as powerful. The lower power devices are generally used for cellular health and bone healing. The higher power devices are generally used for recovery of trauma from accidents, sports injuries and surgery, as well as for control and improvement of degenerative diseases. Both low power and high power devices help reduce pain, but the higher power devices are more effective in doing so.

• Continuous or Pulsed medical Waveform

Although there are exceptions in both types, most low power PEMF devices have a continuous waveform while most high power PEMF devices have a pulsed waveform.

• Shape of Waveform

The continuous waveform PEMF devices can produce a square, a saw tooth or a sine wave. The pulsed output PEMF devices usually produce a biphasic sine wave.

• Control of Frequency

Many low power PEMF devices have preset frequencies to choose from according to the manufacturers' own different theories. Most high power PEMF devices have a user variable control of the frequency.

• Duration of Treatment

Depending on the power level of the PEMF device, the treatment duration can be from three minutes to hours.

Primary Benefits of High Power PEMF

Clinical evidence shows that PEMF therapy reduces pain associated with trauma from accidents, sports injuries, surgeries and burns as well as from disease and degeneration.

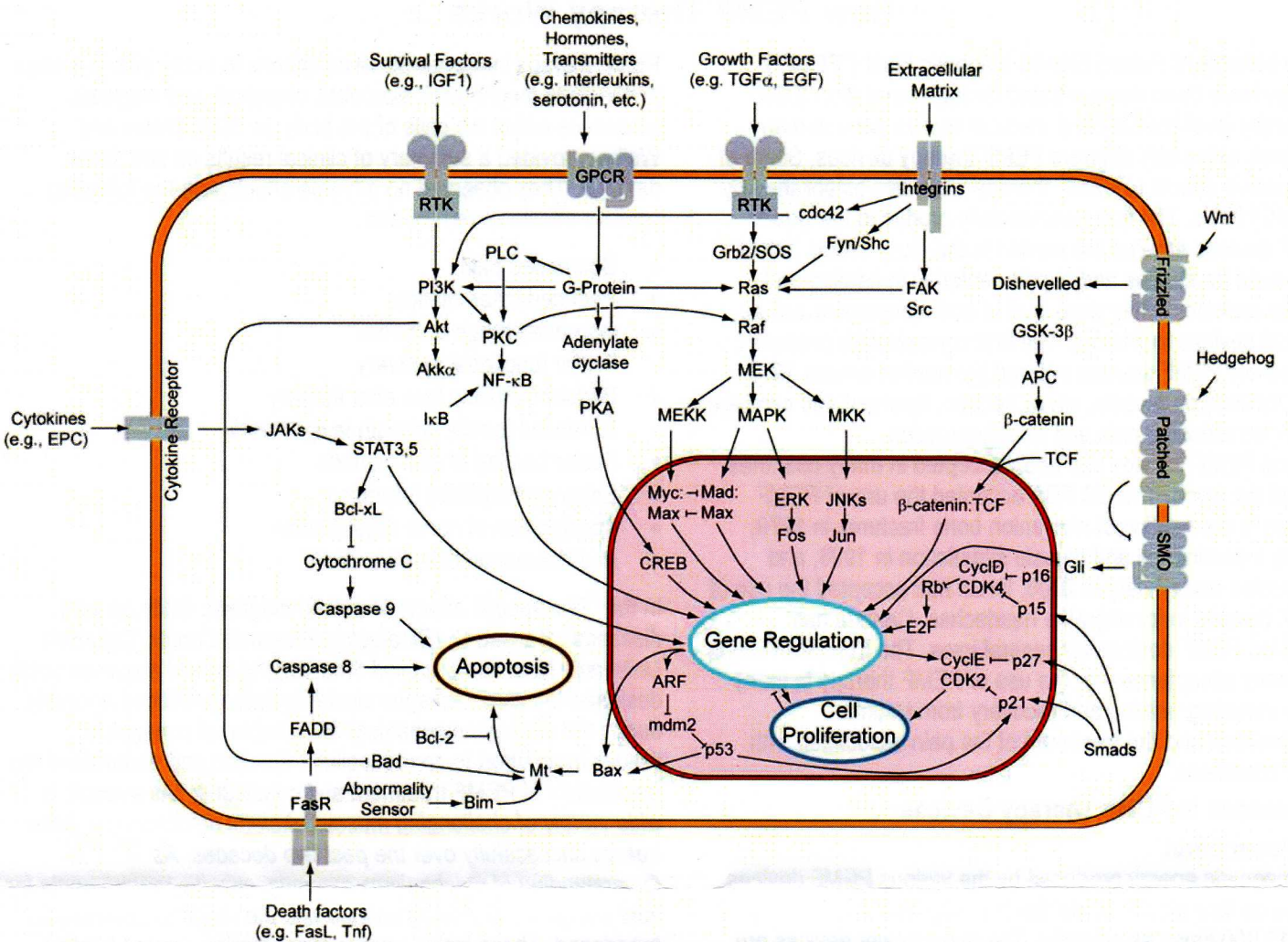
PEMF therapy improves these conditions in many different ways that include mechanical, electrical, chemical, and magnetic processes within the cells of the body. In 1995, Siskin and Walker provided a summary of clinical results on soft tissue damage. They observed no adverse effects and the following positive effects were reported:

- Decreased pain
- Reduced inflammation
- Increased range of motion
- Faster functional recovery
- Reduced muscle loss after surgery
- Increased tensile strength in ligaments
- Faster healing of skin wounds
- Enhanced capillary formation
- Acceleration of nerve regeneration
- And decreased tissue necrosis.

In the "Therapeutic effects of pulsed magnetic fields on joint diseases", Bassett C. (*Bioelectric Research Center, Columbia University New York*) applied time-varying pulsed magnetic fields designed to induce voltages similar to those produced normally during the dynamic mechanical deformation of connective tissues in an effort to control cellular function and understand the mechanism of PEMF treatment and concluded: "As a result, a wide variety of challenging musculoskeletal disorders has been treated successfully over the past two decades. As understanding of mechanisms expands, specific requirements for field energetics are being defined and the range of treatable ills broadened. These include nerve regeneration, wound healing, graft behavior, diabetes, and myocardial and cerebral ischemia (heart attack and stroke), among other conditions. Preliminary data even suggest possible benefits in controlling malignancy".

The Dynamics of Pain and PEMF Therapy

For most individuals, aside from the multiple benefits of the therapy, one of the most relevant effects of PEMF therapy is the improvement of painful conditions regardless of their origin. During the last 100 years, theories of pain mechanism have evolved from specificity and summation models to the popular gate control theory. The latter pain theory, proposed by Melzack/Wall/Casey (*Wall and Melzack, 1989*) has become the most important development in the field of pain management. Pain perception is no longer a straightforward afferent transmission of pain signal. In biology, signal transduction is a mechanism that converts a mechanical or chemical stimulus to a cell into a specific cellular response. Signal transduction starts with a signal to a receptor, and ends with a change in cell behavior. Transmembrane receptors move across the cell membrane, with half of the receptor outside the cell and the other half inside the cell. The signal, such as a chemical signal, binds to the outer half of the receptor, which changes its shape and conveys another signal inside the cell. Sometimes there is a long cascade of signals, one after the other. Eventually, the signal creates a change in the cell, either in the DNA of the nucleus or the cytoplasm outside the nucleus.



Overview of signal transduction pathways

In the chronic pain state, pain signal generation can actually occur in the central nervous system without peripheral noxious stimulation. In pain management, modulation of the pain signal transmission is a far better choice than neural destruction, and that can be achieved with PEMF. Scientific evidence shows that acute persistent pain eventually sensitizes wide dynamic neurons in the dorsal horn of the spinal cord, the wind-up phenomenon, constituting the basis of developing chronic pain syndromes (Kristensen, 1992). Persistent and excessive pain has no biological good or necessary function. It is actually harmful to our well-being. Therefore, pain needs to be treated as early and as completely as possible and not to be left alone (Adams, et al 1997).

The primary symptom in most patients with disorders affecting the soft tissue is pain. In many patients, daily activities are limited as pain causes a restriction of the range of movements. Causes of soft tissue pain can be depicted as musculo-skeletal, neurologic, vascular, and referred visceral-somatic or articular (Cailliet, 1991). Early reports of applying electrical current to treat pain date back to before 1800 (Ersek, 1981).

PEMF therapy has successfully been used for the control of pain associated with rotator cuff tendonitis, multiple sclerosis, carpal tunnel syndrome, and peri-arthritis (Battisti et al, 1998; Lecaire et al, 1991). An improvement was observed in 93% of

patients suffering from carpal tunnel pain and in 83% in cases of rotator cuff tendonitis. PEMF therapy was also used for treatment of migraine, chronic pelvic pain, neck pain, and whiplash injuries (Rosch et al, 2004).

PEMF Therapy Reduces Pain

Many studies have demonstrated the positive effects of PEMF therapy on patients with pain, even as opposed to receiving traditional treatment as well as against a placebo group getting no treatment. Some studies focused on the rapid, short-term relief while others demonstrate the long-term effects. The effectiveness of PEMF therapy has been demonstrated in a wide variety of painful conditions.

In a study entitled: "Double-blind, placebo-controlled study on the treatment of migraine with PEMF", Sherman R. et.al. (Orthopedic Surgery Service, Madigan Army Medical Center, Tacoma, WA, USA) evaluated 42 subjects who met the International Headache Society's criteria. During the first month of follow-up with exposure to PEMF, 73% of those receiving actual exposure, reported decreased headaches with 45% a substantial decrease and 14% an excellent decrease. Ten of the 22 subjects who had received actual exposure received 2 additional weeks of actual exposure, after their initial month. All showed decreased headache activity with 50% a substantial decrease and 38% an excellent decrease. Sherman R. et.al concluded that