



## **Pulsed Magnetic Field Therapy and the Physiotherapist**

**by Dr. D. C. Laycock**

The therapeutic effect of the application of pulsed magnetic field therapy (PMFT) has at last received world-wide recognition, although for a long time many practitioners saw it only as an aid to fracture union. Research has now shown that it has the potential to improve a wide range of conditions, although few understood just how it achieved its effectiveness. Extensive research has since been carried out to determine the mechanism by which this occurs. For the physiotherapist, presented with a wide range of clinical problems, PMFT is an invaluable aid to the clinic.

### **Resolution of Soft Tissue Injuries**

Over the past few years, research has shown that its effectiveness is not through heat production - as is the case with some modern treatments - but is at the cellular level. One significant outcome of this is the effect it has on soft tissue injuries. As early as 1940 it was suggested that magnetic fields might influence membrane permeability. It has since been established that magnetic fields can influence ATP (Adenosine Triphosphate) production; increase the supply of oxygen and nutrients via the vascular system; improve the removal of waste via the lymphatic system; and help to re-balance the distribution of ions across the cell membrane. Healthy cells in tissue have a membrane potential difference between the inner and outer membrane. This causes a steady flow of ions through its pores. In a damaged cell the potential is raised and an increased and an increased sodium inflow occurs. As a result, interstitial fluid is attracted to the area, resulting in swelling and oedema.

The application of PMFT to damaged cells accelerates the re-establishment of normal potentials (Sansaverino 1980 <sup>1</sup>) increasing the rate of healing and reducing swelling. This can help to disperse bruising also. A magnetic field pulsed at 5Hz with a base frequency of 50Hz can have the same effect as an ice pack in that it causes vaso-constriction.

### **Effects on Fracture Repair**

Acceptance of magnetic fields in medicine came about foremost in the field of orthopaedics. Low frequency and low intensity fields have been used extensively for the treatment of non-union fractures. By 1979 this method was approved in the USA as a safe and effective treatment for non-union fractures; for failed arthroses; and for congenital pseudoarthroses.

According to Bassett <sup>2</sup> (1983) the method has been used by more than 6,000 surgeons. The success rate was over 80% for tibial lesions. No patient suffered complications and biological side-effects included improved healing and increased neural function.

In-depth research carried out to investigate this shows that magnetic fields influence the process of bone formation in the intercellular medium. Madronero <sup>3</sup> (1990) showed that bone healing was promoted by means of the influence of the magnetic field on the crystal formation of calcium salts.



## **Pain Reduction**

Pulsed magnetic field therapy has been shown to bring about a reduction of pain, which again is due to action at the cellular level.

Pain is transmitted as an electric signal which encounters gaps at intervals along its path. The signal is transferred in the form of a chemical signal across the synaptic gap and this is detected by receptors on the post-synaptic membrane. A charge of about -70mV exists across the inner and outer membranes, but when a pain signal arrives it raises this to +30mV. This action causes channels to open in the membrane, triggering the release of a chemical transmitter and allowing ions to flow into the synaptic gap. The cell then re-polarises to its previous resting level.

Research by Warnke <sup>4</sup> (1983) suggests that PMFT affects the quiescent potential of the membrane, lowering it to a hyper-polarised level of -90mV. Transmission is effectively blocked since the pain signal is unable to raise the potential to the level required to trigger the release of the chemical transmitter. Again, the frequency of the applied magnetic field is important, as the most effective frequency to produce this effect was found to be a base frequency of 200Hz pulsed at between 5 and 25 pulses per second.

## **Clinical applications**

The value of pulsed magnetic field therapy has been shown to cover a wide range of conditions, with well documented trials carried out by hospitals, rheumatologists and physiotherapists. For example, the department of rheumatology at Addenbrookes Hospital, Cambridge <sup>5</sup> (1984), carried out investigations into the use of PMFT for the treatment of persistent rotator cuff tendinitis. The treatment was applied to patients who had symptoms refractory to steroid injection and other conventional treatments. At the end of the trial, 65% of these were symptom free, with 18% of the remainder being greatly improved.

Lau <sup>6</sup> (School of Medicine, Loma University, USA) reported on the application of PMFT to the problems of diabetic retinopathy. Patients were treated over a 6 week period. 76% of the patients had a reduction in the level of numbness and tingling. All patients had a reduction of pain, with 66% reporting that they were totally pain-free.

Many research studies, including Lau <sup>7</sup>, reported on the application of PMFT for conditions such as sports injuries and for patients with joint and spinal problems. Although these are too numerous to mention individually, in almost every instance there was a reduction, if not complete resolution of symptoms. Soft tissue injuries and joint pains tended to be resolved within 5 days of treatment. Patients with cervical problems and low back pain were also successfully treated, whereas previous treatment with ice, traction and other therapies had been unsuccessful. In yet another trial, the effect of applying PMFT to sufferers of Multiple Sclerosis was investigated (Geseo A. <sup>8</sup> 1987). 70% of sufferers had a reduction of weakness, pain and spasticity, with 50% reporting improvement of their bladder incontinence.

Through the evaluation of hundreds of research papers, a number of points have been established regarding PMFT:



- a) The field must be pulsed, with low frequency and low intensity to achieve the best effect.
- b) Different conditions require different frequencies. For example, 5Hz causes vaso-constriction whilst 10Hz and above causes vaso-dilation.
- c) Biological effectiveness is achieved in just 10 minutes for most injuries, so that long treatment sessions are not required.
- d) When used at the correct level there are no recorded side effects. Although PMFT is not yet recommended for use during pregnancy or in the presence of tumours, there are papers to suggest that magnetic fields can inhibit the growth of tumours.

### References:

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