The Science Supporting the Use of Pulsing Electromagnetic Field Therapy and ONDAMED® Part 1

by Jim Oschman, PhD

Figure 1

An Introduction to ONDAMED®

ONDAMED® is an integrated diagnostic/therapeutic system, combining Pulsing Electromagnetic Field (PEMF) therapy and biofeedback. Extensive biomedical research published in the peer-reviewed literature has shown that both PEMF and biofeedback are safe and effective for a wide range of conditions, as is being documented by the case studies described in this article and additional studies published elsewhere.

PEMF induces tiny microcurrents into tissues, and a form of biofeedback known as the vascular autonomic signal (VAS), detected with the radial arterial pulse, is used to select the appropriate frequencies and anatomical locations for stimulation. ONDAMED® is unique because it adjusts treatments to the individual patient. Moreover, the induced currents are well below the levels that cause nerves to depolarize. Hence, the patient rarely senses the stimulation, except for the faint sounds emitted by the coils. These sounds and the selected positions of the stimulation coils provide biofeedback to the patient.

The process begins with placing a magnetic applicator around the patient's neck to introduce frequencies into their body (Figure 1). The operator then scans through a range of PEMF frequencies from 0.5 to 32,000 Hz by turning the wheel on the regulator (Figures 2 and 3). When a physiologically significant frequency is induced into the body via the applicator, there is a subtle but palpable change in the radial artery pulse (Figure 4). This is the VAS, which will be described in more detail below. When a response is detected, the operator depresses a button on the regulator (Figure 5), and the ONDAMED® stores the frequency in its memory.

When the full range of frequencies has been scanned, the ONDAMED® is shifted to a treatment mode. The operator then scans the body with a hand-held applicator (Figure 6) that emits the same frequencies to which the body responded. The appropriate anatomical position of the applicator and the optimal distance from the body are determined, again guided by the radial artery pulse. Various other applicators are available to treat large areas such as the spine or the abdomen. A second mode of operation involves using the radial artery pulse to select between 173 preset programs with bundled frequency patterns, preset time, and intensity.

The Science Behind PEMF

PEMF was originally developed and tested for the treatment of fracture non-unions and delayed union, both of which are costly and debilitating conditions. The method has been accepted by many in the orthopedic community and is widely used.[1] Extensive basic research revealed the probable underlying mechanisms, and extensive multi-center clinical trials documented safety and effectiveness and led to FDA approval.[2] Pulsing electromagnetic fields applied to the outside of the body induce small but measurable microcurrents within the tissues (Figure 7). Two firmly established nineteenth-century laws of electromagnetism are involved: Ampere's Law states that the flow of electric currents, as in a wire or coil, must produce magnetic fields in the surrounding space; and Faraday's Law of Induction states that oscillating magnetic fields, such as those produced by a coil, will give rise to oscillating electric currents in nearby conductors, including in living tissues.

Success with bone healing led to testing PEMFs on other tissues, and it was soon found that each tissue responds to a particular frequency. PEMF signals were identified that could stimulate healing in skin, ligament, tendon, muscle, and nerve.[3] Key to the success of PEMF is the use of very low levels of stimulation, so that the currents flowing through a bone fracture or other injured tissue are on the order of the currents set up naturally within tissues when they are stretched or compressed. ➤

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The mechanisms by which these microcurrents are produced during normal movements have been documented and involve the piezoelectric effect and streaming potentials.[4]

The peer-reviewed literature now contains references to a wide variety of tissues that respond favorably to low level signals of particular frequencies. The National Library of Medicine database, Pub Med, lists 234 publications and 13 review articles on PEMF published between 1981 and the present. Clinically significant frequencies range from 0.1 Hz to millions of Hz. Some of the tissues and physiological processes affected are shown in Table 1, which is based on the peer-reviewed biomedical literature. Some of the processes and the corresponding frequencies are shown in Table 2.[5] A variety of PEMF devices have proven safe and effective, and those devices have been given FDA approval and are marketed for treatment of a variety of clinical issues.

Figure 2

Table 1
Processes Responding to Pulsing Electromagnetic Fields, from the Peer-Reviewed Literature

Melatonin secretion
Nerve regeneration
Neurite outgrowth
Osteogenesis
Cartilage growth
Ligament healing
Cell growth
Collagen production
DNA synthesis
Decreased skin necrosis
Angiogenesis
Fibroblast proliferation
Lymphocyte activation

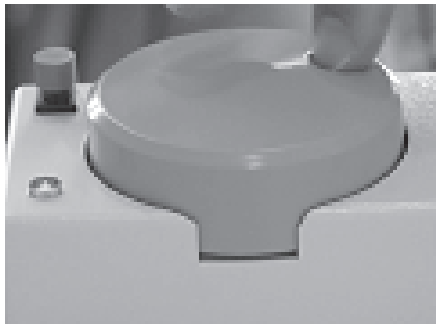

Figure 3

The reason cells are sensitive to such tiny signals has been determined in great detail. Researchers have defined a cascade of events that take place across the cell surface, through the cytoplasm, and to the nucleus, where transcription is activated. In essence, cells amplify tiny signals. The calcium channel is involved: a single photon of energy can trigger the entry of thousands of calcium into the cell, where they activate particular activities or cellular behaviors.[6]

As with any clinical procedure, methods employing PEMF are not effective on 100% of the patient population. For example, a series of multi-center clinical trials of PEMF in treating fracture non-unions[7] or dental problems[8] showed that the method was effective in 64% to 97% of cases, depending on measurement protocols. We can ask why all patients did not respond.

The answer to this question emerged from studies of Peters and colleagues, who showed that the optimal therapeutic frequencies must be determined on an individual basis.[9] This raises another question: how can we determine the optimal frequency for the individual patient? Biofeedback using the radial artery pulse, or VAS answers this question.

The VAS evolved from the work of a French physician, Dr. Paul Nogier, who taught neurology at the medical school in Lyon, France. Nogier also studied Traditional Oriental Medicine, which includes sophisticated methods of analyzing the radial artery pulse. In 1966, Nogier discovered that the Vascular Autonomic Signal was evoked in the radial pulse (termed the RAC in French, for Réflexe Auriculo-Cardiaque or Autonomic Circulatory Reaction) when he touched certain points on the ear of a patient. Subsequently, he discovered that the arterial system responds in a reproducible manner to a variety of changes to key physiological systems in the body. To be specific, the VAS is a rapid change in the tone of the smooth muscles in the walls of the arterial system throughout the body, mediated by sympathetic and parasympathetic neurons.[10, 11] Detectable changes in the pulse are triggered by specific events within the body. The effect is consistent and is both repeatable and measurable by modern equipment. There is considerable medical interest in the VAS, as evidenced by five International Symposia, the most recent one held in Lyon, France in 2006. Several United States Patents[12] and both diagnostic and therapeutic tools are based on the phenomenon. The method is sometimes referred to as Peripheral Arterial Tonometry, or PAT.

Figure 4

Although the term "signal," as in the "Vascular Autonomic Signal," is widely used, many who use the system consider the term "response" more accurate. A response is an answer to a question, and the VAS is the body's reaction or answer to a question posed by the introduction of

Table 2
Frequencies Affecting Particular Tissues

2.0 Hz ..... Nerve repair
5.9 Hz ..... Scars
7.0 Hz ..... Bone
9.7 Hz ..... Ligaments
13.5 Hz ..... Muscle
15 Hz ..... Blood pressure
15 Hz ..... Lymphatic circulation
15 Hz ..... Emotional stability
15 Hz ..... Emotional Trauma
15 Hz ..... Herniated disc
15 Hz ..... Fluid Retention in Joints & Tissues,
15.2 Hz .... Capillaries
17 Hz ..... Blood Flow / Circulation
24.3 Hz ..... Fluid Retention in Joints & Tissues
25.4 Hz ..... Herniated Disc
35 Hz ..... Mental clarity
326 Hz ..... Calcium Metabolism
326 Hz ..... Herniated disc
326-328 ... Back Pain
337 Hz ..... Circulation
443 Hz ..... Chemical Sensitivity
480 Hz ..... Pineal
528 Hz ..... DNA Integrity
625 Hz ..... Kidney
635 Hz ..... Pituitary Function
635 Hz ..... Colon
637 Hz ..... RNA Integrity
645 Hz ..... Pituitary
657 Hz ..... Nerve repair
751 Hz ..... Liver
657 Hz ..... Electrical Sensitivity
676 Hz ..... Lymphatics
696 Hz ..... Heart
763 Hz ..... Thyroid
763 Hz ..... Progesterone
764 Hz ..... Nervous System
835 Hz ..... Immune System
1335 Hz ... Adrenals
1342 Hz .... Pituitary
1351 Hz .... Hypothalamus
1413 Hz .... Hypothalamus
1434 Hz ... White Cell Production
1443 Hz .... Progesterone
1446 Hz .... Progesterone
1524 Hz .... Red Blood Cell Production
1534 Hz .... Hypothalamus
1537 Hz .... Endocrine System
1351 Hz .... Estrogen
1444 Hz .... Testosterone-male
1445 Hz .... Testosterone-female
1565 Hz .... Spiritual Well-Being
1725 Hz .... Pituitary
2452 Hz ... Hemoglobin Production
2642 Hz .... Stroke

stimulation into the body or into its energy field. (For a discussion of the term, "energy field," see Oschman.[6])

The VAS is rapid and extremely sensitive, and it can be used to discover both the best treatment for a problem as well as more subtle levels of disturbance or imbalance. These include blockages to the healing response, layers of pathology, appropriate priority for treatments, and even subclinical issues. The VAS can be used both before and after a treatment to determine the accuracy of the diagnosis and the success of the treatment. In essence, the VAS is a very sensitive way of "listening" to the body as well as a way to provide

Table 3
Medical Applications of Biofeedback with Sound from the Peer-Reviewed Literature

Acute pain management
Fibromyalgia
Childhood migraine
ADHD
Sensorimotor learning
Stutter and dysfluency
Tinnitus
Velopharyngeal dysfunction in cleft palate
Balance improvement
Gait in spina bifida.
Handwriting disabilities
Chronic asthma
Parkinsonian dysarthria
Post-stroke movement disorders
Incontinentence
Speech rehabilitation in dysarthria brain damage after trauma
Irritable bowel syndrome
Raynaud's phenomenon
Motor aprosodia
Velopharyngeal dysfunction
Motor aprosodia
Brain injury
Ocular vergence
Sensorimotor learning and stuttering
Nocturnal bruxism
Spastic dysphonia
Hyperfunctional voice disorder

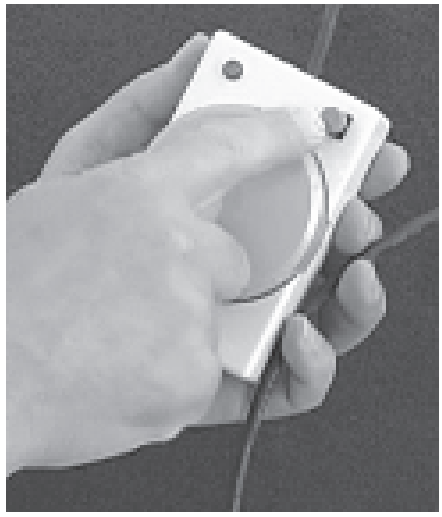

Figure 5

feedback to the patient. A wide variety of therapeutic schools around the world train practitioners to read the VAS and use it to define areas of the body under stress, the causes of the stress, chemical intolerances, and the degree of success of interventions. The VAS can also provide early warnings of subclinical issues and therefore provide the practitioner with the opportunity to reverse developing conditions at an early stage.[13]

Biofeedback

The fundamental discovery providing the basis for biofeedback is that most physiological processes previously thought to be regulated automatically (autonomic nervous system) can be regulated consciously if the processes can be brought to awareness via appropriate measurements. Since most physiological events in the body have electrical correlates, many biofeedback technologies involve measurements of electrical events as the feedback signa.

As with PEMF, there is an extensive body of peer-reviewed literature on the safety and clinical effectiveness of biofeedback for the treatment of a variety of conditions, some of which are difficult to resolve by other methods. Table 3 lists some

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Figure 6

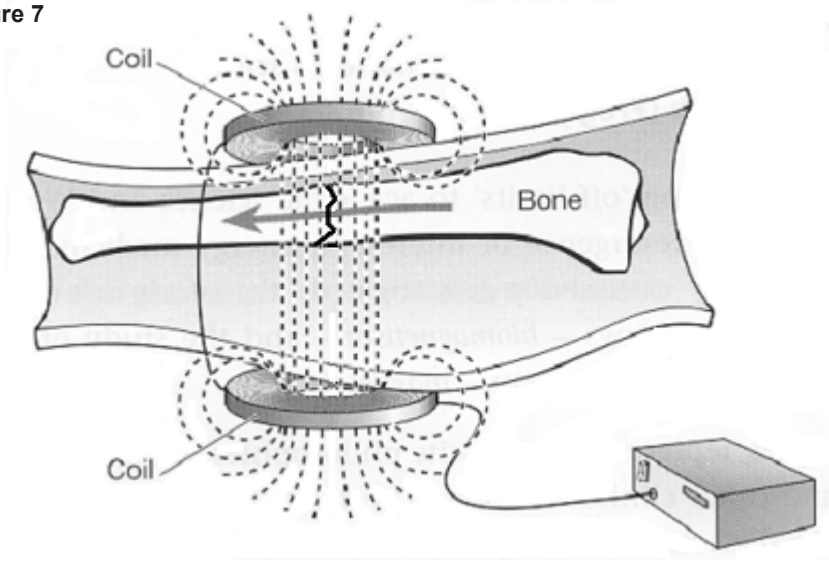
of the conditions in which sound is used as the biofeedback signal. Other ways of providing biofeedback include light, electrical stimulation, and even wave-forms viewed on an oscilloscope. Again, like PEMF techniques, biofeedback has proven non-invasive, safe, and effective for a wide variety of conditions, and most biofeedback technologies have FDA approval. Moreover, biofeedback has the advantage that it is patient-specific. In other words, the patient's own body regulates the process and determines when the end-point has been reached.

Combining PEMF and Biofeedback

ONDAMED combines PEMF and biofeedback for both diagnosis and therapy. The VAS provides feedback on the responses of the body to specific frequencies, and the sounds emitted by the hand-held applicator and its anatomical location provide feedback during the treatment phase. In practice, biofeedback continuously informs both patient and practitioner during the diagnostic and treatment procedures.

ONDAMED® has been used successfully in Europe since 1993 and is now being used by physicians and other health care providers throughout the US. The case studies described in Part 2 of this article (in next month's *Townsend Letter*) will document the clinical success of PEMF combined with biofeedback. Of particular interest to the physician is the growing list of instances in which ONDAMED® has resolved clinical issues for patients who have tried all of the conventional treatments and have run out of options.

Figure 7



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Notes

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