Discussion on the Theory of the Physiological Effects of the Nikken PalmMag Device

Devices that produce time-varying magnetic fields are not new. In fact, intentionally or not, people are bombarded by time-varying magnetic fields all the time. From common household appliances to electric power transmission lines, sources of electromagnetic field (EMF) radiation are ubiquitous and constantly growing in numbers in our modem society. Even before the discovery of electricity EMFs were present in nature during every lightening storm. So then, how do these invisible energy fields affect life on this planet? And more specifically, how do they affect us humans? Although much controversy has arisen in recent years over the possible deleterious effects of EMFs from power lines, microwave ovens, and cell phones, this discussion will focus on the clinically verified positive effects of EMFs from devices specifically designed for therapeutic purposes.

Medicall research applications of EMF began almost simultaneously with Michael Faraday's discovery of electromagnetic induction in the late 1700s. This was one of the hallmark discoveries of physics in mankind's history and has led to the invention of numerous electromagnetic devices, which are an inextricable part of modem society, as we know it today. Faraday's Law basically states that a magnetic field is created whenever an electric current passes through a conduct, and this magnetic field will induce an electric current in a neighboring conductor as the magnetic field moves across the conductor. The key here is movement of the magnetic field relative to a conductor or vice versa. While a conductor is conventionally thought of as a piece of copper wire, in reality a conductor is anything that allows the free flow of charged particles whether they be electrons or ions. With this in mind, in an unconventional sense, the entire human body can be thought of as one large conductor since it composed mostly of water, which is replete with, dissolved salts and minerals producing trillions of ions. On a smaller scale, the various components of the human body act as conductors to one degree or another. In fact, the function of the entire human nervous system relies on ionic conduction through the nerve membrane. So then one can predict an interaction between moving magnetic. Fields and the human body, according to Faraday's Law with absolute certainty. The question is to what degree is this interaction significant and therapeutically beneficial.

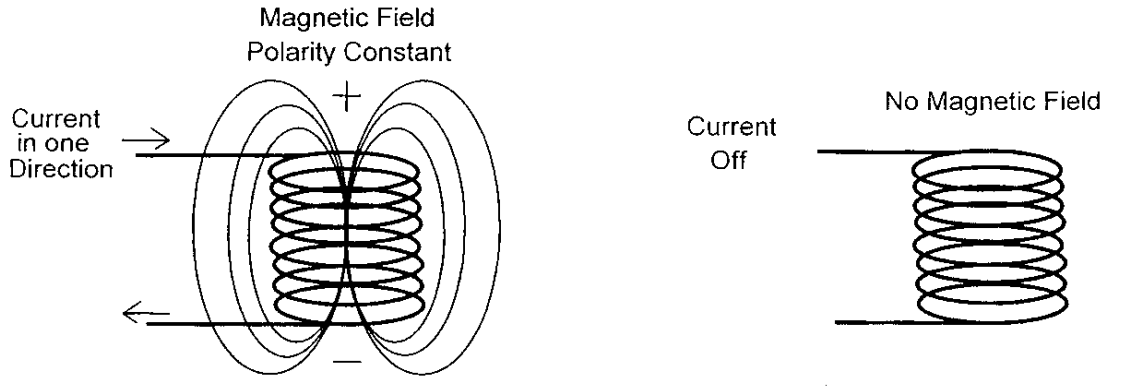
Most of today's medical EMF devices use relatively large levels of electromagnetic energy. In this discussion, however, we will focus on the nonionizing portion of the electromagnetic spectrum, particularly at low levels, which is where the PalmMag operates. An EMF is classified as ionizing if its energy is high enough to dislodge electrons from an atom or molecule. Gamma rays, and X-rays are strongly ionizing in biological matter and, for this reason, prolonged exposure to such rays is harmful. Nonionizing EMF medical applications may be classified according to whether they are thermal (heat producing in biological tissue) or non-thermal. Thermal applications of nonionizing radiation include RF hyperthermia, laser and RF surgery, and RF diathermy. In this respect, the PalmMag would be considered a nonionizing, non-thermal device. In fact, most devices used in magnetic therapy are of the nonionizing and non-thermal type. The term non-thermal is used with two different meanings in the medical and scientific literature. Biologically (or medically) non-thermal means that it "causes no significant gross tissue heating." Physically (or scientifically) non-thermal means "below the thermal noise limit at physiological temperatures." The energy level of thermal noise is much lower than that required to cause heating of tissue; thus, any physically non-thermal application is automatically biologically non-thermal.

In magnetic therapy there are basically two well-known types of EMFs. As previously stated they are Pulsed Electromagnetic Fields (PEMF) and Alternating Current or Sinusoidal Electromagnetic Fields (AC EMF). PEMFs are generated by pulsing current through a conductor, normally a coil. This pulsing effect is produced by simply turning the current on and off. Although the duration of the pulsing effect can vary with each on and off cycle, generally the pulsing rate remains constant at a set frequency until changed by the operator. A magnetic field is generated simultaneously from the current flow and mimics the frequency and intensity of the current, which produced it. AC EMFs are similar to PEMFs with the exception that AC EMFs are generated by AC current, i.e., current that continually reverses direction at a periodic rate. The magnetic field "blossoms" from the conductor coil which carries the current in both PEMF and AC EMF devices. This can be likened to water springing forth from a fountain. When the water release valve is opened, the water sprays out of the fountain jets. Observing this in slow motion, the water emerges from the jets streaming up and out. Gravity causes the individual water streams to turn around after reaching a certain height according to the water pressure. In a similar fashion the magnetic field from a PEMF or AC EMF device emerges from the current carrying coil inside the device and extends out a certain distance according to the amount of current generated by the voltage and the number of turns of coil through which the current moves. The individual lines of magnetic force known as flux, in a similar fashion to the jets of water, turn around in their outward path and go in the opposite direction. Instead of gravity, polarity causes the change in direction since magnetic fields always have a north and south pole which completes the magnetic circuit. Technically, once a magnetic field is created, its lines of force extend out into infinity. But practically speaking, its influence ends when it decreases in intensity to that of the surrounding magnetic field generated by the earth, which is about half of a gauss. Yet radio waves and microwaves can have much lower magnetic field strength and still be picked up by receivers designed to detect such waves, such as our radio tuners and cell phones. How does this happen? The answer is frequency. While the intensity of the magnetic is extremely low compared to the earth's magnetic field, the frequency of the magnetic wave actually "rides" on the earth's field creating tiny ripples that can be detected by sensitive instruments like radios and cell phones. This amazing phenomenon makes wireless communication over great distances possible. A magnetic field can start off very strong at its source and it will attenuate by the square of the distance according to the laws of physics. So, for example, if the magnetic field emanating from a coil is measured at 100 gauss one inch away, it will only measure 25 gauss two inches away. Doubling the distance results in one quarter of the magnetic strength. You can see how quickly a magnetic field deteriorates to very small levels at short distances. At a distance of only a foot, the magnetic field in this example would be less than a gauss! But once that magnetic field is turned on and off or periodically reverses direction then the ripple effect is created and anything sensitive enough to detect it will be influenced.

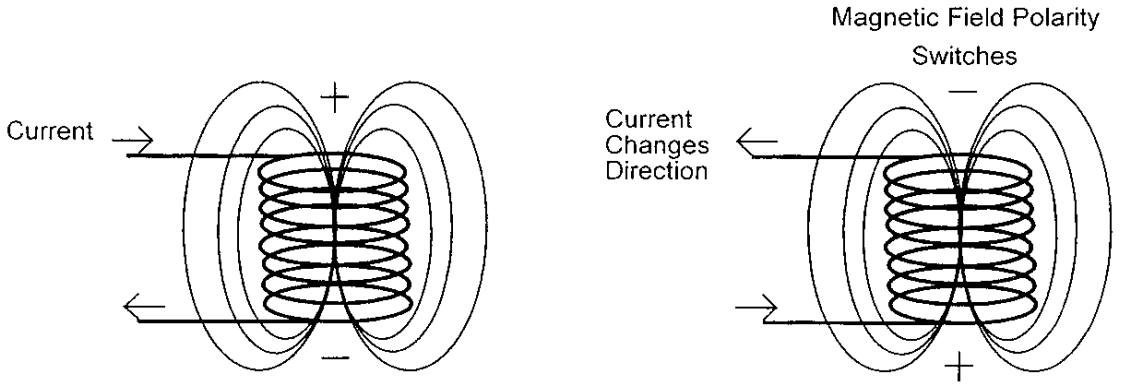
It may seem doubtful that very low-level magnetic ripples can have any influence on the human body, but documented research indicates otherwise. For instance, microwave resonance therapy, which is used primarily in Russia, employs low-intensity microwave radiation to treat a variety of conditions, including arthritis, ulcers, esophagitis, hypertension, chronic pain, cerebral palsy, neurological disorders, and side effects of chemotherapy (Devyatkov et al., 1991). Thousands of people in Russia also have been treated by specific frequencies of extremely low-level microwaves (less than 1/1000th of a gauss) applied at certain acupuncture points. The mechanism of action of microwave resonance therapy is thought to involve modifications in cell membrane transport or production of chemical mediators or both. Although a sizable body of Russian-language literature on this modality already exists, no independent validation studies have been conducted in the West. However, if such treatments prove to be effective, current views on how biological information is stored in molecular and cellular structures may need revision. It may be that such information is stored at the level of the whole organism in an exogenous field (existing outside the body). And that very low-intensity fields are sufficient to influence this exogenous field, which is inextricably linked to the living endogenous system.

If extremely low-level EMFs can have an influence on the human body, then it stands to reason that higher level EMFs may have an even greater influence. In fact, most EMFs used in therapy are at much higher levels than the ones used in microwave resonance. These devices generate their magnetic fields using electric current. However, it is also well known that permanent magnets produce magnetic fields without the use of current. Permanent magnets are used mainly in magnetic therapy as static field devices, meaning that they produce a field without a frequency. However, rotating permanent magnets can also create EMFs similar to PEMFs and AC EMF. Additionally, rotating permanent magnets produce an entirely unique type of EMF, which I term "Dynamic Direct Current Magnetic Fields" (DDCMF). Although no current is used to produce the magnetic field of a permanent magnet, permanent magnets produce direct current (DC) fields. The term DC is used because if direct current is passed through a coil of wire, a static magnetic field is produced which is the same as the static magnetic field produced in permanent magnets. The terms "static magnetic field" and "DC magnetic field" are often used interchangeably in magnet industry jargon.

The concept of DDCMFs is more than just a fancy name. It describes the action of a magnetic field that has characteristics not found in any other type of magnetic field. Not only is the behavior of a DDCMF different than a PEMF and AC EMF in certain respects, but also these differences have profound implications. In order to understand these implications we need to examine the properties of each type of field. First, let's look at exactly how a pulsed or AC magnetic field is generated. A very simple example would be to take a coil of wire and periodically cause a current to flow through it. If the current flows in one direction it would create a pulsed magnetic field emanating from the coil. If the current alternates back and forth it would create an AC magnetic field. These concepts are illustrated in the following drawings:



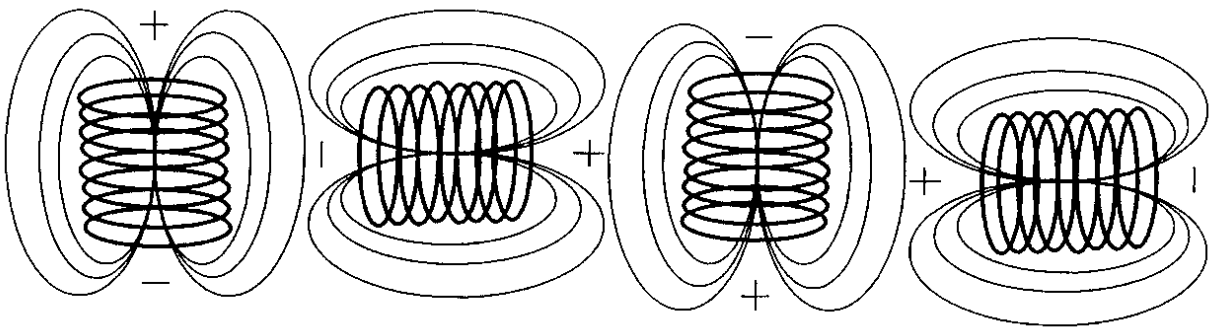
PEMF Illustration



AC EMF Illustration

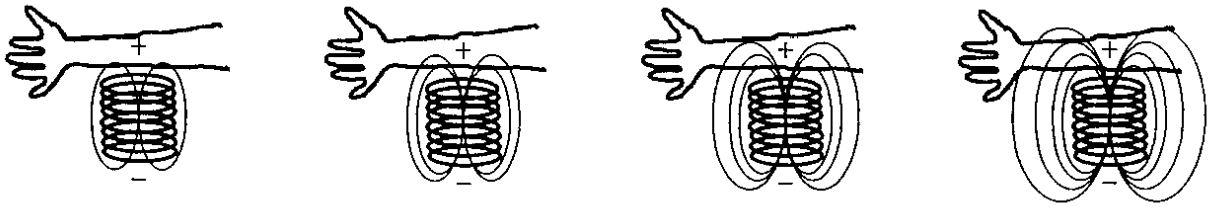
The plus and minus signs over the coils represent magnetic polarity, not electrical. The plus sign customarily signifies south polarity and the minus north polarity. However, it should be noted that an electric field is also present which pulses and alternates at the same frequency as the current, hence the term electromagnetic field (EMF). Also, the intensity of the magnetic and electric field is directly proportional to the amount of current passing through the coil. Hence, the magnetic field generated from a coil receiving 2 amps of current will be twice as strong as the magnetic field generated from the same coil receiving only 1 amp.

Let's see now how a dynamic DC magnetic field differs from the PEMF and AC EMF. The DDCMF starts off very much like the PEMF. Using the coil example, a direct current is passed through a coil of wire generating a magnetic field with a constant polarity. But here is where the similarities end. The current passing through the coil never turns off or reverses direction, but remains constant. Then, the entire coil is caused to rotate bringing the magnetic field surrounding it along for the ride. This is illustrated below:

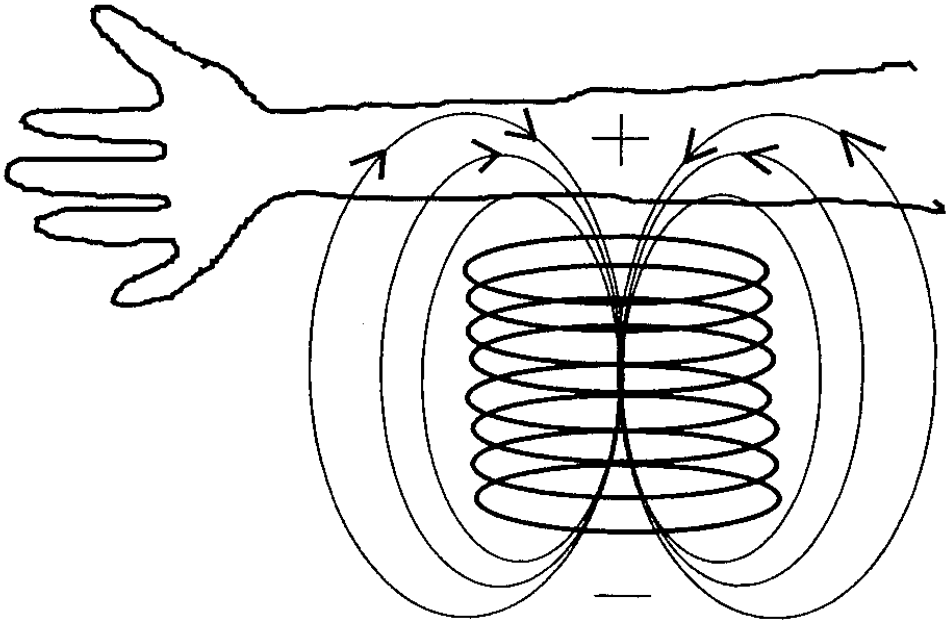


DDCMF illustration

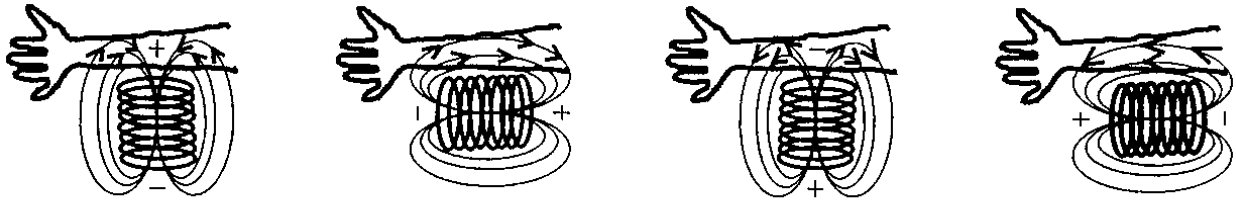
The question now arises, "why is this significant"? Well, in terms of magnetic therapy this is very significant because the lines of magnetic force passing through biological tissue behave much differently among the different types of magnetic fields. Let's look first at how a PEMF would impinge upon a part of the human body; an arm, for instance:



The above illustration shows how the field grows and expands out from the coil into the arm. In a PEMF there is a periodic expansion and contraction of the field as the current is turned on and off through the coil. The magnetic lines of force (flux lines) follow one path through the tissue as the field expands and contracts. A close-up reveals this in greater detail:



The same is true for the AC EMF, except that the field changes polarity periodically which causes the magnetic lines of force to reverse direction through the tissue. In both the PEMF and AC EMF the flux lines follow the same path, and the intensity of the flux (the number of lines of magnetic force) increases as the field expands and decreases as the field contracts. Now, let's take a look at what happens with a DDCMF:



It is clear to see from the above illustration that the paths of the magnetic flux lines are continually changing. This is very significant because the targets of magnetic therapy are the nerves in the body. Neural orientation is a generally random situation. Applying a magnetic field to optimally effect a given nerve is a hit or miss proposition. By continually changing the path that magnetic lines of force follow, an increased probability of optimal magnetic/neural interaction occurs.

The PalmMag 1000 goes one step further and continually changes the flux path along two rotational axes, instead of one. This added dimension of spatial influence greatly enhances the probability that more nerves will be optimally affected by the magnetic field. Since bi-axial movement produces flux path changes in three dimensions it is more difficult to illustrate in a drawing. But the concept can be described with an analogy. Using water again as a substitute for the magnetic field, consider how you would best wash dirt off your driveway or any other object. If you operate your garden hose like a PEMF device you would periodically squeeze the handle to turn the water on and off. If you were fast enough you might squeeze it 5 times per second, or at a frequency of 5 Hz. But you cannot move

the hose around while you do this. It must point in one direction while you squeeze the valve handle on and off. To be sure, some of the dirt will be washed away. With an AC EMF the analogy would be like squeezing the handle on gradually until the water stream is fully open then gradually releasing the handle until it is fully shut off, repeating this very quickly over and over again at a certain frequency. Again you are not permitted to move the hose around while performing this operation. Once again, some of the dirt would surely be washed away. Now we come to the DDCMF analogy with bi-axial rotation. In this case you never turn the hose off. Instead you continually change the direction of the hose nozzle so that the water sprays out in different directions. And while you are doing this you simultaneously alter the angle at which the stream of water hits the ground. If you can imagine this all happening very quickly and continuously you would soon realize that the dirt would be cleared away much faster and more thoroughly. In fact, when people wash the soap off of their cars with a hose they instinctively wiggle the hose nozzle around and constantly change the angle of the spray to get the soap off more completely.

Such examples may seems elementary but they drive home the point that the way magnetic flux lines move can influence the effect they have on the body. Since the PalmMag is an entirely new device that is patent pending and it utilizes an innovative new type of EMF, studies to verify its enhanced efficacy need to be conducted. But preliminary anecdotal reports thus far have been astounding. Cases of chronic lower back pain, intractable knee and shoulder immobility, painful sciatic nerve inflammation, to name a few, have yielded to the PalmMag's incredible ability to bombard the tissue with magnetic flux at a multitude of different angles dramatically increasing the probability that the optimal angle of magnetic influence will be achieved for each given condition. No negative side effects have yet to be observed regardless of the duration of the treatments. In the interest of furthering the medical field's effective arsenal of noninvasive modalities, clinical trials using the PalmMag should commence without delay.