

An Introduction to Microcurrent Electrical Therapy

Joseph M. Mercola and Daniel L. Kirsch (1995) coined the term "microcurrent electrical therapy" (MET) to define a new form of electromedical intervention using biocompatible waveforms.

Patrick DeBock (2000), a physiotherapist at the University of Antwerp in Belgium, recently compared MET with TENS based on the Eight Parameter Law which covers every possible influence in electrotherapy. In his conclusion, DeBock states, "MET has a completely different mechanism, which at this time is not fully understood, but works on a cellular level...It looks as if TENS is going to lose this competition...MET will, in most cases, be much more satisfying than TENS because of the longer lasting and more intense effects."

A growing body of research shows the effectiveness of MET to do more than control pain. It can actually accelerate and even induce healing. When a wound is dry, its bioelectric current flow is shut off. Eaglstein and Mertz (1978) have shown moist wounds to resurface up to 40% faster than air-exposed wounds. Falanga (1988) found that certain types of occlusive dressings, like Duoderm, accelerate the healing of wounds. It is probable that these dressings achieve their effects by promoting a moist environment (Kulig, Jarski, & Drewek, 1991). The moisture may allow endogenously produced current to flow more readily through the injury, and thus promote wound healing. Electrical stimulation of the wound has a similar effect, and also tends to increase the amount of growth factor receptors which increases the amount of collagen formation (Falanga, 1987).

Electricity was first used to treat surface wounds over 300 years ago when charged gold leaf was found to prevent smallpox scars (Robinson, 1925). There are several recent studies supporting the beneficial effects of treating wounds with an artificial current (Goldin, 1981; Jeran, 1987; Ieran, 1990; Mulder, 1991). Experimental animal wound models in the 1960's demonstrated that electrical intervention results in accelerated healing with skin wounds resurfacing faster, and with stronger scar tissue formation (Carey & Lepley, 1962; Assimacopoulos, 1968).

Assimacopoulos (1968a) published the first human study using direct current for wound healing. He documented complete healing in three patients with chronic leg ulcers due to venous stasis after six weeks of electrical therapy. One year later Wolcott and Wheeler (1969) published the most frequently cited work in the history of electrical wound healing.. They used direct currents of 200-1,000 microamperes on 67 patients. Gault and Gatesn (1976) repeated the Wolcott and Wheeler protocol on 76 additional patients with 106 ischemic skin ulcers. Rowley et al. (1974) studied a group of patients having 250 ischemic ulcers of various types. These included 14 symmetrical control ulcers. The electrically stimulated ulcers had a fourfold acceleration in healing response compared to the controls. Carley and Wainapel (1985) performed one of the only studies on this subject published with equal and randomized active and control groups. All of these studies documented significant accelerated healing from electrical stimulation.

One additional consistent observation in these studies was a reversal of contamination in the wounds. Wounds that were initially contaminated with *Pseudomonas* and/or *Proteus* were usually sterile after several days of MET. Other investigators have also noticed similar improvements and encourage the use of this therapy as the preferred treatment for indolent ulcers (Kaada, Flatheim, & Woie, 1991; Barron & Jacobson, 1985; Lundeberg, Eriksson, & Malm, 1992; Alvarez et al., 1983). Additionally, no significant adverse effects resulting from electrotherapy on wounds have been documented (Weiss, 1990). A review of the literature by Dayton and Palladino (1989) shows that MET is clearly an effective and safe supplement to the non-surgical management of recalcitrant leg ulcers.

Some of these studies used unipolar currents that were alternated between negative and positive based on various criteria. Some researchers initially used negative current to inhibit bacterial growth and then switched to positive current to promote healing. To date no study has compared this variable of MET. However, there is some compelling basic science research, and one animal study suggesting that a biphasic waveform, which provides both negative and positive current, may be better in that it both sterilizes the wound and promotes wound healing (Stromberg, 1988; Windsor, Lester, & Herring, 1993).

In the 1960's Robert O. Becker (1985) demonstrated that electrical current is the trigger that stimulates healing, growth, and regeneration in all living organisms. He found that repair of injury occurs in response to signals that come from an electrical control system, and suggested that this system became less efficient as we age.

Becker developed his theory of biological control systems based on concepts derived from physics, electronics, and biology. He postulated that the first living organisms must have been capable of self-repair, otherwise they never would have survived. The repair process requires a closed-loop system. A specific signal is generated, called the current of injury, which causes another signal to start repair. The injury signal gradually decreases over time with the repair process, until it finally stops when the repair is complete. Such a primitive system does not require demonstrable consciousness or intelligence. In fact, many animals actually have a greater capacity for healing than humans.

Science has amassed a vast amount of information on how the brain and nervous system work. Most of this research involves the action potential as the sole mechanism of the nerve impulse. This is a very sophisticated and complex system for the transfer of information. It is helpful to compare this conceptualized concept of the nervous system to a computer.

The fundamental signal in both the computer and the nervous system is a digital one. Both systems transfer information represented by the number of pulses per unit of time. Information is also coded according to where the pulses originate, where they go and whether or not there is more than one channel of pulses feeding into an area. All our senses (e.g., smell, taste, hearing, sight and touch) are based on this type of pulse system. Like a computer, the nervous system operates remarkably fast and can transfer large amounts of information as digital on and off data.

It is unlikely that the first living organisms had such a sophisticated system. Becker believes they must have had a much simpler mechanism for communicating information because they did not need to transmit large amounts of sophisticated data. Accordingly, they probably used an analog system. An analog system works by means of simple DC currents. Information in an analog system is represented by the strength of the current, its direction of flow, and slow wavelength variations in its strength. This is a much slower system than the digital model. However, the analog system is extremely precise and works well for its intended purpose.

Becker theorizes that primitive organisms used this analog type of data-transmission and control system for repair. He postulates that we still have this primitive nervous system in the perineural cells of the central nervous system. These cells comprise 90% of the nervous system. The perineural cells have semiconductor properties that allow them to produce and transmit non-propagating DC signals. This system functions so vastly different from the "all or none" law of propagation of the nerve action potentials that Becker called this the fourth nervous system.

This analog system senses injury and controls repair. It controls the activity of cells by producing specific DC electrical environments in their vicinity. It also appears to be the primary primitive system in the brain, controlling the actions of the neurons in their generation and receipt of nerve impulses. Accordingly, as knowledge of this aspect of our nervous system is uncovered, another mystery of brain physiology may be explained, including the regulation of our consciousness and decision-making processes. Given this understanding, the application of the correct form of electrical intervention is a powerful tool for treating pain, initiating the endogenous mechanisms for healing, and altering states of consciousness.

Chang (1982) proposed another mechanism for MET. His research showed that microcurrent stimulation increased adenosine triphosphate (ATP) generation by almost 500%. Increasing the level of current to milliamperage levels actually decreased the results. Microcurrent was also shown to enhance amino acid transport and protein synthesis in the treated area 30 to 40% above controls.

It would be helpful to review the cellular nature of an injury to fully appreciate the importance of Chang's research. Becker (1985) has shown that trauma will affect the electrical potential of cells in damaged tissues. Initially the injured site has a much higher resistance than that of the surrounding tissue. Basic physics dictates that electricity tends to flow towards the path of least resistance. Therefore endogenous bioelectricity avoids areas of high resistance and takes the easiest path, generally around the injury. The decreased electrical flow through the injured area decreases the cellular capacitance (Windsor, 1993). As a result, healing is actually impaired. This may be one of the reasons for inflammatory reactions. Pain, heat, swelling, and redness are the characteristics of inflamed tissues. Electricity flows more readily through these hot inflammatory fluids.

The correct microcurrent application to an injured site augments the endogenous current flow. This allows the traumatized area to regain its capacitance. The resistance of the injured tissue is then reduced allowing bioelectricity to enter the area to reestablish homeostasis. Therefore microcurrent electrical therapy can be viewed as a catalyst helpful in initiating and sustaining the numerous chemical and electrical reactions that occur in the healing process.

When a muscle experiences trauma it goes into spasm to protect itself. This decreases its blood supply reducing the amount of oxygen and nutrients that reach it. The decreased circulation causes an accumulation of metabolic waste products. This acts as noxious input resulting in pain.

Adenosine triphosphate is an essential factor in the healing process. Large amounts of ATP, the cell's main energy source, are required to control primary functions such as the movement of vital minerals, like sodium, potassium, magnesium and calcium, into and out of the cell. It also sustains the movement of waste products out of the cell. Injured tissues are deficient in ATP.

As MET restores circulation and replenishes ATP, nutrients can again flow into injured cells and waste products can flow out. This is necessary for the development of healthy tissues. As ATP provides the energy tissues require for building new proteins, it also increases protein synthesis and membrane transport of ions.

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