

Microcurrent Electrical Therapy Heals a Recalcitrant Wound in a Horse

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Abstract

A two-year old mare sustained a large wound from an injury. After one month of recalcitrant surgical and topical intervention, a course of therapy with a new form of electrical stimulation for healing was undertaken. Alpha-Stim® microcurrent electrical therapy (MET) was delivered around the wound site using pulsed, modified square waves of 100 microamperes at 0.5 Hz continuously around the clock for three weeks. The wound exhibited substantial healing during the treatment. Three months later the horse was completely healed and was able to resume all her normal activities. Possible mechanisms are discussed.

Introduction

Electricity was first used to treat surface wounds over 300 years ago when charged gold leaf was found to prevent smallpox scars. (1) Experimental animal wound models demonstrated that electrical intervention results in accelerated healing with skin wounds resurfacing faster, and with stronger scar tissue formation (2,3).

Moist wounds resurface up to 40% faster than air-exposed wounds. (4) When a wound is dry, its bioelectric current flow is reduced. The moisture may allow endogenously produced current to flow more readily through the injury, and thus promote wound healing. Externally applied

electrical stimulation of the wound may have a similar effect, and also tends to increase the amount of growth factor receptors which increases the amount of collagen formation (5).

Joseph M. Mercola and Daniel L. Kirsch coined the term "microcurrent electrical therapy" (MET) to define a new form of electromedical intervention using less than one milliamper of current delivered in biocompatible waveforms. (6)

Wounds 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. (7-9) Additionally, no significant adverse effects resulting from electrotherapy on wounds have been documented. (10) A review of the literature shows that MET is an effective and safe supplement to the non-surgical management of recalcitrant leg ulcers. (11)

In this case report a two-year old mare with a large wound was successfully healed with MET.

Materials and Methods

Alpha-Stim® prescription medical technology (Electromedical Products International, Inc., Mineral Wells, TX, www.alpha-stim.com) has been on the market for 24 years and is approved by the Food and Drug Administration for treating pain, anxiety, depression and insomnia in humans. It has been used in about 60 research studies. One study examined the efficacy of Alpha-Stim® in the treatment of 8 thoroughbred horses. In a double-blind study, observers blind to the treatment condition recorded duration of behaviors of body locomotion, head motion, ear

position, oral behavior and the state of the lower lip. There were significant improvements in each of these behaviors in the treatment group ($p < 0.05$), but not in the sham treated group. (12)

This is the first documented report using Alpha-Stim® MET to heal a wound in a horse. The patient is a two-year-old American Quarter Horse mare that had fallen on top of a T-post, creating a very large wound to her right rear quarter damaging the tuber coxae. Bone fragments were surgically removed, the rough surface filed smooth, flushed and the remaining wound sutured as much as possible. The suture line extended ventrally to the right flank and caudally almost to the ischium. The anterior portion post-surgically was a large gaping wound. One month of antibiotics, flushing and treating topically ensued with slow progress. The area failed to develop healthy granulation tissue and the wound became infected.

MET was initiated on March 8, 2004 using the Alpha-Stim® PPM. Four AS-Trode brand silver electrodes were placed around the wound to encompass the injury site. The small PPM unit was duck taped on the dorsum of her rump at the tuber sacralae. At that time the total length of the wound was 18 inches cranial to caudal with the open lesion being 8 inches in length.

The Alpha-Stim PPM is preset at 0.5 Hz. To induce healing, the current was set at 100 microamperes. The horse was treated seven days per week, 24 hours per day for three weeks. By choice the mare did not lie down on the affected side, so there was no problem with the device attachment. The device and electrodes were checked daily, changing the 9-volt battery and AS-Trodes, along with shaving the attachment site as required.

Insert Figures 1-6 about here

Results

Figures 1 and 2 show the horse at the initiation of treatment, on March 8, 2004. Figure 2 indicates the placement of the electrodes. Figures 3, and 4, taken after ten days of MET show substantial healing and a clean wound. Figure 5 was taken after MET treatment was completed on March 30, after a total of three weeks of daily treatment. Figure 6, the final picture were taken July 1, 2004 when the horse was returned to training.

Possible Mechanisms

Robert O. Becker demonstrated that electrical current is the trigger that stimulates healing, growth, and regeneration in all living organisms. (13) 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 with 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 (COI), which causes another signal to start repair. The COI 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 self-consciousness or intelligence. In fact, many animals 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 better than a digital one for its intended purpose.

Becker theorizes that primitive organisms used an analog type of data-transmission and control system for repair. He found 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 it the “fourth nervous system”.

This analog system senses injury and controls repair. It controls the activity of cells by producing specific direct current 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. Given this understanding, the application of the correct form of electrical intervention is a powerful tool for initiating the endogenous mechanisms for healing.

Chang proposed another mechanism for MET. His research showed that microcurrent stimulation increased adenosine triphosphate (ATP) generation by almost 500%. (14) Increasing the level of current to milliampere 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. Trauma will affect the electrical potential of cells in damaged tissues. (13) 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. (15) 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.

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.

Conclusion

In this case, microcurrent electrical therapy proved to be a safe and effective means for reducing the healing time and bacterial contamination of a large wound and may have saved the horse's life. This therapy can be done in an animal hospital or at home with the appropriate instructions

from the veterinarian. Since the device is reusable after the wound heals, it is an economical approach that may prove superior to other conventional long-term wound management measures. A prospective controlled study is needed to more fully explore the potential of MET for wound healing.

About the Author

Ava Frick earned her DVM degree in 1980. In 1997 she began researching methods, other than drugs, which could be effective in pain management. Her current practice, Animal Fitness Center, is an animal rehabilitation facility with a special focus on balancing the autonomic nervous system using clinical nutrition, microcurrent therapy and chiropractic. She lectures to veterinarians on these topics and is host to an online radio talk show at www.VoiceAmerica.com.

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Figures 1-6



Figure 1. 3-8-2004. One month post wound, at initiation of MET therapy.

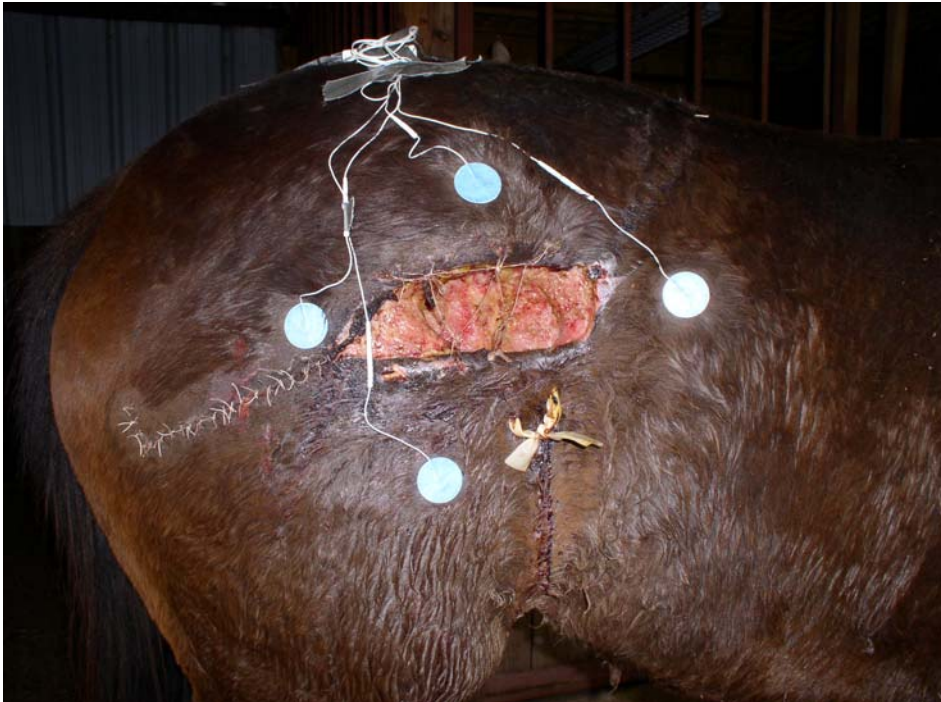


Figure 2. 3-8-2004. At initiation of MET therapy to show proportion of wound. Note also the lack of skin available to cover wound site.



Figure 3. 3-18-04 Ten days of MET showing substantial healing and a clean wound.

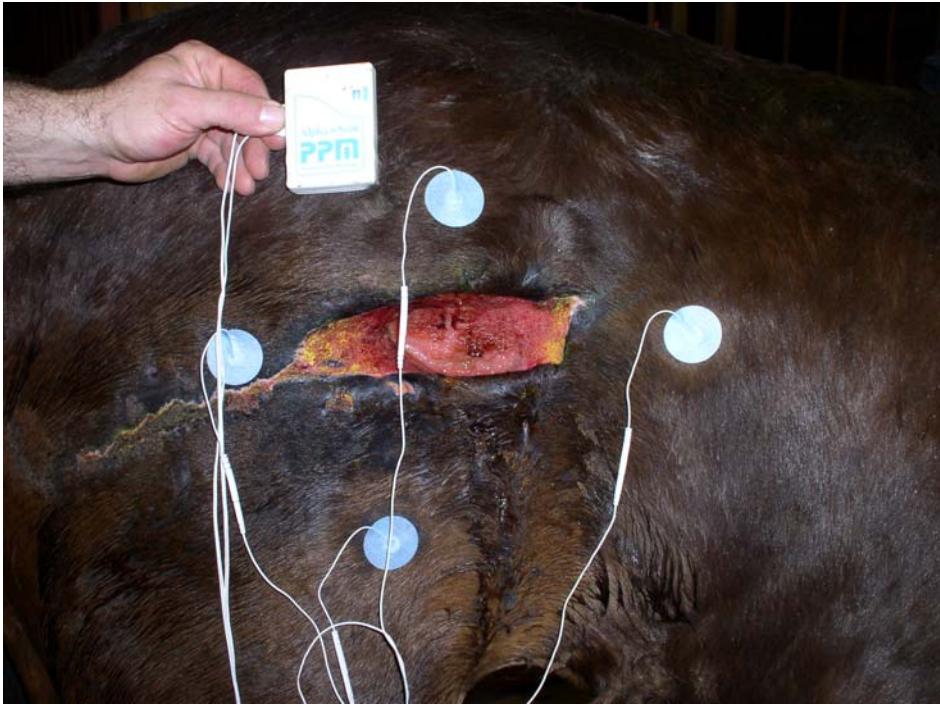


Figure 4. 3-18-04 Ten days of MET showing the device used.



Figure 5. 3-30-04 After three weeks of MET treatment was completed.



Figure 6. 7-1-2004. The horse was returned to training.