

## Research Studies

### **Cell Regeneration and ATP Production** :The Effects of Electric Currents on ATP Generation, Protein Synthesis, and Membrane Transport Clinical Orthopaedics and Related Research, #171, Nov/Dec. 1982

*Summary:* Research shows that ATP (adenosine triphosphate) levels increase with the application of micro current and diminish with millicurrent (Cheng 1982). The increase of ATP peaked at 500 micro amps and decreased rapidly at higher current levels. Cheng also observed that aminoisobutyric acid uptake increased dramatically beginning at 10 micro amps and inhibitory effects began at 750 micro amps. The uptake of aminoisobutyric acid which is essential for protein synthesis and membrane transport, showed an increase of 30 - 40%.

**Mechanism** During electro stimulation, proton gradients are created across the mitochondrial membrane. The current produces a gradient when electrons at the cathode react with water to form hydroxyl ions while producing protons at the anodic side. As a result a proton and voltage gradient are established across the intervening tissues between the electrodes. The influence of the electrical field and the proton concentration difference produce a proton current that moves from anode to cathode. As the migrating protons cross the mitochondrial membrane-bound H<sup>+</sup>ATPase, ATP is formed. The increased ATP production stimulates amino acid transport, and these two factors both contribute to increased protein synthesis. (Cheng, 1982)

### **Pain Reduction**

Data collection study, Micro current Therapy Lynn A. Wallace, PT (1990) MENS Therapy: Clinical Perspectives Vol. 1. Cleveland: privately published. 1990. Distribution.

- \* 94% of the 1531 patients experienced a reduction in pain during the first treatment.
- \* No side effects or increase in symptoms were reported. The overall results were remarkably similar when comparing the first 200 / 400 and 800 cases to the final total of 1531 cases.
- \* Pain reduction occurring after the patient left the clinic was not recorded as pain reduction during treatment.
- \* Patients who discontinued their treatments after significant progress (i.e. pain decrease from 10 to 3) but before reaching a pain free state were recorded as failures.
- \* Similarly, patients whose treatment was discontinued by their physician before reaching a pain free state were recorded as failures.
- \* 96% response in pain relief.
- \* 88% pain free within 10 treatments.
- \* 12 types of acute injuries tested, average pain free = 4 treatments.
- \* Acute radiating cervical pain, average pain free = 3.5 treatments.
- \* Acute lower back pain, average pain free = 4.5 treatments

The following list of criteria was followed:

Patients were asked to rate their pain on a subjective pain scale (0 to 10, with 10 being unbearable pain).

- \* Decreases in pain that were achieved after patients left the clinic were not included.
- \* Biphasic current was used almost exclusively (negative current was used on selected cases with referred spinal pain).
- \* Electrode probes and pads were used.
- \* Daily treatment was encouraged; therefore, the total treatments rendered represent approximately that many days of treatment.
- \* Medication was not altered.
- \* No other modalities (heat, ice, electricity, or mechanical traction) were used.
- \* Instructions such as positioning and avoidance were presented during the first treatment.

#### **Worker's Compensation Injuries Study (283 patients)**

- \* Control group on conventional therapy (hot, cold packs, massage) avg. # of treatments for back to work =20.7
- \* Micro current only: avg. # of treatments for back to work =8.7
- \* Micro current and conventional therapy: avg. # of treatments back to work =8.6

*Result:* 237 % accelerated healing response

#### **Wound Healing**

Electrotherapy for Acceleration of Wound Healing: Low Intensity Direct Current

Carley and Wainapel, Archives of Physical Medicine and Rehabilitation, Vol. 66, July 1985

*Summary:* 30 hospital patients with non healing ulcers were divided into two groups, one treated with conventional wound dressings and one with micro current stimulation at 300-700 uA. The latter group was given two two-hour stimulation periods per day. After six weeks of such treatments, the group treated with micro currents showed a 150-250% faster healing rate, with stronger scar formation, less pain and lessened infection of the treated area.

Accelerated Healing of Skin Ulcers by Electrotherapy

Wolcott, Wheeler, Hardwicke, and Rowley Southern Medical Journal, July 1969.

*Summary:* Researchers applied micro current stimulation ranging from 200-800 uA to a wide variety of wounds, using negative polarity over the lesions in the initial phase, and then alternating positive and negative electrodes every three days. The treated group showed 200-350% faster healing rates than control, with stronger tensile strength of scar tissue and antibacterial effects in infected wounds in the treated group.

**Reported by Lawrence Altman: Cell Channel Finding Earns Nobel Prize New York Times Medical Science section, October, 9, 1991**

**Summary:** Two German scientists, Dr. Erwin Neher and Dr. Bert Sakmann, will share the \$1 million dollar Nobel prize for their development of the patch-clamp technique that allows the detection of minute electrical currents in cell membranes. This discovery, which “revolutionized modern biology” may shed light on the causes of several diseases, like diabetes and cystic fibrosis. This method allowed the detection of 20 to 40 types of ion channels that allow positive or negatively charged ions into and out of the cells. “This study confirmed that electrical activity is not limited to nerve and muscle tissue, as previously thought, but is intrinsic to ‘all kinds of other cells’.

**Bertolucci and Grey: Clinical Comparative Study of Microcurrent Electrical Stimulation to Mid-Laser and Placebo Treatment in Degenerative Joint Disease of the Temporomandibular Joint, Journal of Craniomandibular Practice, 1995**

**Summary:** 48 patients were divided into three groups, some receiving placebo, some microcurrent and some laser to treat pain of TMJ syndrome. Both microcurrent and laser were found to be significantly more effective than placebo, with laser slightly more effective than microcurrent. The author acknowledges that lasers are not legally sold in the United States for this purpose, and that microcurrent’s easy accessibility makes it more practical for practitioners here.

**DuPont: Trigger Point Identification and Treatment with Microcurrent, The Journal of Craniomandibular Practice, October 1999, Vol. 17, #4**

**Summary:** This article gives the author’s techniques for locating and stimulating trigger points (TP’s) using a microcurrent stimulator, specifically for the treatment of temporomandibular disorders. He states that electrical conductivity is highest over trigger points, and galvanic skin response (GSR) testing can be used to locate such points. He utilizes probe electrodes to treat small TP’s, and pad electrodes to treat larger ones. Probe treatment is delivered @ 0.3 Hz, 20 – 40 uA, with treatment time of 10 – 30 seconds per site. He suggests administering treatment in 24-48 hour intervals, and states that results should be seen within 2 – 3 treatments. He acknowledges that these protocols are not necessarily the best ones, but work well for his practice.

**Impedance-controlled microcurrent therapy used for managing radiation-induced fibrosis in head and neck cancer patients.**

26 patients who were experiencing late effects of radiotherapy were treated b.i.d. with microcurrent therapy for one week. Objective range-of-motion measurements were made for cervical rotation, extension-flexion and lateral flexion before therapy, at the end of each treatment day, and monthly for 3 months. In addition, each patient's subjective complaints were tabulated before treatment and re-evaluated at the last follow-up visit. No additional physical therapy or electrical stimulation was permitted during the follow-up period.

Results: At the end of the course of microcurrent therapy, 92% of the patients exhibited improved cervical rotation, 85% had improved cervical extension/flexion, and 81% had improved cervical lateral flexion. 22 patients returned for the 3-month follow up visit. Of these, 91% had maintained a cervical rotation range of motion greater than their pretherapy measurements. 82% maintained improved cervical extension/flexion and 77% maintained improved lateral flexion.

Conclusion: Impedance-controlled microcurrent therapy shows promise for remediation of range-of-motion limitations arising as late effects of radiotherapy for head and neck cancer.

Quoted from Int. J. Radiation Oncology Biol. Phys. Vol. 54, #1, pgs. 23-24, 2002