Research Findings – Microcurrent Stimulation

- Carley and Wainapel: Electrotherapy for Acceleration of Wound Healing: Low Intensity Direct Current 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 microcurrent 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 microcurrents showed a 150-250% faster healing rate , with stronger scar formation, less pain and lessened infection of the treated area

- Wolcott, Wheeler, Hardwicke, and Rowley: Accelerated Healing of Skin Ulcers by Electrotherapy Southern Medical Journal, July 1969.

  Summary: These researchers applied microcurrent 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.

- Gault and Gatens: Use of Low Intensity Direct Current in Management of Ischemic Skin Ulcers Physical Therapy, Vol. 56, #3, March 1976.

  Summary: 100 patients with skin ulcers were treated with microcurrent stimulation; six of them had bacterial ulcers with one side used as controls. Stimulation of 200-800 uA was applied, with negative polarity used until infection cleared, and then polarity reversed. Patients had diagnosis ranging from quadriplegia, CVA, brain tumor, peripheral vascular disease, burns, diabetes, fracture, and amputation. The lesions with patients treated with microcurrent showed twice the rate of healing.

- Cheng, et Al: The Effects of Electric Current on ATP Generation, Protein Synthesis, and Membrane Transport in Rat Skin Clinical Orthopaedics and Related Research, #171, Nov/Dec. 1982

  Summary: These researchers used in vitro slices of rat skin to determine some of the biochemical explanations for accelerated wound healing demonstrated in the above studies. By applying various levels of current to the samples, and then chemically analyzing them, they determined that skin treated at currents below 1000 uA showed up to 75% higher amino acids and up to 400% more available ATP than controls, and that skin treated at levels above 1000 uA showed depressed levels of these substances. Often less than non-treated controls.

- Rowley, McKenna, and Wolcott: Proceedings: Use of Low Level Electrical Current for Enhancement of Tissue Healing. Biomedical Scientific Instruments #10, 1974

  Summary: This article is an overview of theory and research into the titled field.

- Tomoya Ohno (Japanese): Experimental Studies of Influences on Healing Process of Mandibular Defect Stimulated by Microcurrent Shikwa Gakuho, #82 1982

  Summary: 50 uA microcurrents were applied to one side of the jaws of a group of dogs with lesions in their jaws. The other side was untreated. The dogs were examined at periods of 3, 7, 14, 21, 28, 42 and 56 days. Results: "It seems likely that direct microcurrent promotes normal bone formation within the defective area and accelerates the osseous healing process. Prolonged application of electrical stimulus promotes a remarkable bone remodeling mechanism."

- Sinitsyn, Razvozva (Russian): Effects of Electrical Microcurrents on Regeneration Processes in Skin Wounds Ortop Travmatol Protez, Feb. 1986

Summary: 68 patients with post burn and post traumatic wounds underwent treatment constant and modulated microcurrent of negative polarity of 1-10 uA/cm2 over a period of 2-20 days. Although both groups showed accelerated regeneration, the modulated electric current group showed more prolonged and marked effect. Better survival of skin grafts was demonstrated compared with untreated patients.

- Sinitsyn, Razvozova, (Russian): Stimulation of the Regeneration of Skin Wounds by Microcurrents Vopr Juroortol Fizioter Lech Fiz Kult, Nov.-Dec. 1985

- Nessler and Mass: Direct-Current Electrical Stimulation of Tendon Healing in Vitro Clinical Orthopedics and Related Research, April 1987

Summary: 80 tendons from white rabbits were surgically transected and removed from the animals after being surgically repaired. They were divided into 4 groups of 20, and cultured with 10 of each group being electrically stimulated, and half not. A 1.4 volt direct current connected through a 150 kOhm resistor was used for stimulation, at a current of about 7 uA. It was found that currents any higher than this caused discoloration of the tendons. Healing was measured by proline uptake and bridging of the repair site by the epitenon. Results: "a continuous direct current causes increased tendon cell activity within seven days and the increased activity may persist as long as 42 days." The researchers suggested that externally applied microcurrents may be preferable in future studies.

- Stanish and Gunlaughson: Electrical Energy and Soft-Tissue Injury Healing Sportcare and Fitness, Sept/Oct 1988

Summary: This article is a summary of research into tendon healing acceleration, including human injuries of the anterior cruciate ligament and the Achilles tendons: "While the results are subjective, the individuals in both groups appear to have returned to usual activities more quickly, and have greater mobility, than people treated more conventionally."

- Vanable, Joseph: The Role of Endogenous Electrical Fields in Limb Regeneration Limb Development and Regeneration, Part A. pages 587-596 Alan Liss Publishing, N.Y. 1983

- Oweye, Spielholz and Nelson: Low-intensity Pulsed Galvanic Current and the Healing of Tenotomized Rat Achilles Tendons: Preliminary Report Using Load-to-Breaking Measurements Archives Physical Med Rehab, Vol. 68, July 1987

Summary: 60 rats were divided into three groups of 20. One was unstimulated, one group had their Achilles tendons stimulated with positive (anodal) current, and the third group's tendons were stimulated with negative (cathodal) currents. A current of 75 microamps, at 10 Hz was used. Results: "The group treated with anodal current withstood significantly greater loads ($p<0.001$) than did either the group which healed normally (i.e. without stimulation) or the group treated with cathodal currents".

- Reichmanis, Marino, and Becker: Electrical Correlates of Acupuncture Points IEEE Transactions on Biomedical Engineering, November, 1975

Abstract: Employing a wheatstone bridge, skin conductance was measured over those putative acupuncture points on the large intestine and pericardium meridians lying between the metacarpophalangeal joints and the elbow. Results were compared to those from anatomically similar locations devoid of acupuncture points. "At most acupuncture points on most subjects, there were greater electrical conductance maxims than at control sites."

- Richez, Chamay and Bieler, U. of Geneva: Bone Changes Due to Pulses of Direct Electric Microcurrent, Virchows Arch. Abt. A Path Anat. 357, 11-18 (1972)

  Summary: 26 rabbits had platinum electrodes surgically implanted into the medullary cavities of their humerus bones. Microcurrent stimulation was applied at 50 and 250 uA, allowing pause periods of one second between one second treatment bursts. The scientists found that osteogenesis (bone growth) happened more around the cathode (negative polarity), and that slight tissue necrosis occurred around the anode. The tissues stimulated acted as capacitors, discharging 75% of the current absorbed during the rest periods. They concluded that pulsed current is superior to direct current for bone healing acceleration.

- J.A. Spadaro, S.E. Chase, and D.A. Webster: Bacterial inhibition by electrical activation of percutaneous silver implants, Journal of Biomedical Materials Research, Vol. 20, 565-577 (1986)

  Summary: Percutaneous silver wire implants were placed in rats, and the wounds inoculated with Staphylococcus aureus to test how much infection would spread. Microcurrent stimulation was passed through the wires, with + anodal current placed into implanted silver wire, and the - cathodal electrode placed on the rat's belly as a ground. It was found that significant inhibition of infection occurred, with the most marked results at 20uA current level. "Metallic silver can be effectively and efficiently activated to elicit its anti-microbial activity by the application of microampere electrical current."

- M. Heffernan: Comparative Effects of Microcurrent Stimulation on EEG Spectrum and Correlation Dimension, Integrative and Behavioural Science, July-September, 1996, Vol. 31, #3

  Summary: 30 subjects were selected for a study comparing the effects of microcurrent on smoothing of EEG measurements of the brain. Subjects were randomly assigned to three groups - microcurrent (100uA) applied to earloble, trapezius area of shoulder, and no stimulation. Electrodes were arranged so subjects could not tell which group they were in. Fast Fourier Transform (FFT) and correlation dimension from chaos analysis were used to measure results. The researcher found that microcurrent applied to the shoulders was markedly more effective in smoothing EEG patterns than earlobe or placebo. "This would represent a possible cost-effective alternative to neurofeedback in treating (anxiety and attention deficit disorders), by raising low regions in the FFT.

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

  Summary: This article gives the authors 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 8pt 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 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. 2) Vanable, Joseph: The Role of Endogenous Electrical Fields in Limb Regereration Limb Development and Regeneration, Part A, pgs. 587-596, Alan Liss Publishing, N.Y., 1983 2) Vanable, Joseph: The Role of Endogenous Electrical Fields in Limb Regereration Limb Development and Regeneration, Part A, pgs. 587-596, Alan Liss Publishing, N.Y., 1983