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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.

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Byl, McKenzie et.al.: Pulsed Microampereage Stimulation: A Controlled Study of Healing of Surgically Induced Wounds in Yucatan Pigs, Physical Therapy, Volume 74, Number 3/March 1994

Summary: This study failed to confirm the superiority of microcurrent-stimulated wounds in test pigs over controls. A good review of previous studies is given as well as a discussion of which research variables could account for the inconclusive results, which vary from other studies that found microcurrent to be efficacious for wound healing.

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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 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

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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 analysing 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

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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 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.

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Gault and Gatens: Use of Low Intensity Direct Current in Management ofIschemic 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 tumour, peripheral vascular disease, burns, diabetes, fracture, and amputation. The lesions with patients treated with currents showed approximately twice as fast a healing rate.

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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 earlobe, 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.

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.”

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'".

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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.

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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”.

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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”.

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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.

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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 uintreated patients.

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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”.

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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."

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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.

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