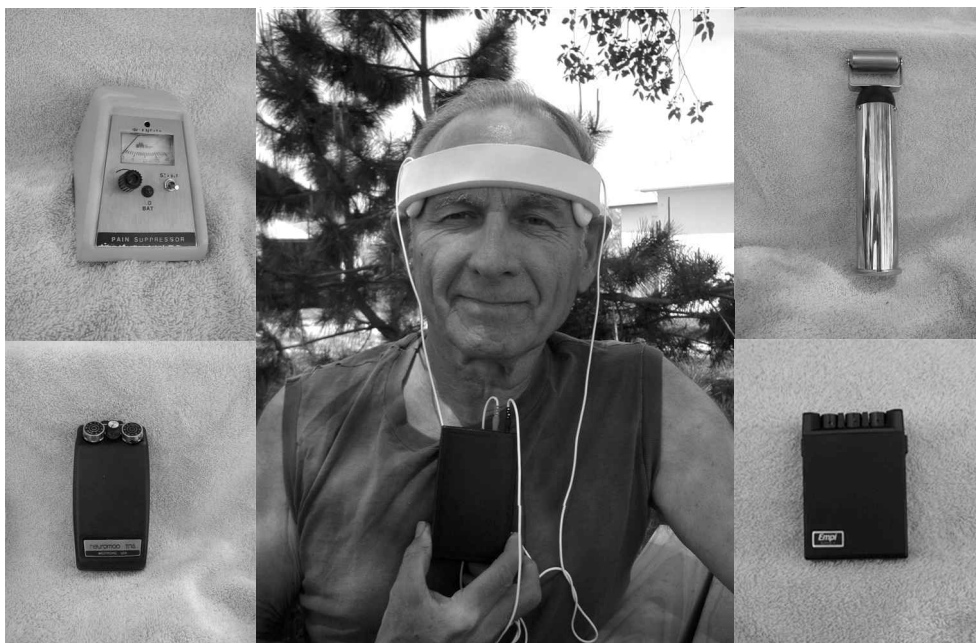


PHOTOESSAY

## Transcutaneous Electrical Nerve Stimulation: The Treatment of Choice for Pain and Depression

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Medtronic transcutaneous electrical nerve stimulation (TENS) devices. Center: C. Norman Shealy, M.D., Ph.D., shown with the Current Liss Cranial Electrical Stimulator (MEDI Consultants, Paterson, NJ). Top left: The original Liss Stimulator (MEDI Consultants). Bottom left: Neuromod<sup>®</sup> original Medtronic TENS (Medtronic, Columbia Heights, MN). Top right: Original Electreat, (no longer made; manufacturer was Electreat, Inc., Peoria, IL). Bottom right: Empi<sup>®</sup> TENS (Empi, Inc., St. Paul, MN). Photographs by Kimbra Brower, Holos Institutes of Health, Inc., Fair Grove, MO.

**E**lectrotherapy for pain has been used since 2751 BC (Kellaway, 1946) but entered modern use in 1919 with the introduction of the Electreat (Shealy, 1974). Working with this device in 1966, I asked engineers to create a similar modern solid-state unit. Initially reluctant, engineers created the first solid-state stimulator for pain control in 1971, the Stim-Tech<sup>®</sup> and shortly thereafter the Neuromod<sup>®</sup> (Medtronic, Columbia Heights, MN) but neither unit pro-

duced my desired optimal quality of stimulation. The pharmaceutical industry tried to destroy transcutaneous electrical nerve stimulation (TENS) when Johnson & Johnson (New Brunswick, NJ) took over Stim-Tech. The parent company apparently felt that this device could compete with Tylenol<sup>®</sup> (Johnson & Johnson)! In 1982 a Federal court suit led to a \$77 million judgment against Johnson & Johnson for fraud. To a large extent the pharmaceutical

industry has continued to attempt to ignore the benefits of TENS, the single most effective form of pain control. Nevertheless, such devices and scores of subsequent TENS devices have gained modest acceptance and usage throughout the world with reported pain relief of up to 80% in acute pain and 50% in chronic pain. For 30 years I have had the goal of having TENS be the major approach to pain control. And, for 28 years, I have seen the possibility that such devices could replace antidepressants! As alternative and complementary medicine increases in acceptance, both of these goals may at last be possible.

With few exceptions, most TENS units emit square wave or capacitor-coupled square wave pulses at 2–100 pulses per second (Hertz [Hz]) and a maximum current of 60 milliamps. All of these are considered to be safe except in patients with implanted cardiac pacemakers or other electronic devices. The exceptions are microcurrent TENS units that produce up to 15,000 Hz at currents up to 4 milliamps. I have studied the Liss TENS units (MEDI Consultants, Paterson, NJ) (called Cranial Electrical Stimulators [CES], when used trans-cranially) in more than 25,000 patients. The Liss devices produce 15,000 pulses per second, modulated at 15 and 500 Hz. These devices have been most successful in transcranial applications, which increase beta endorphin and serotonin significantly and that are extremely helpful for treating depression and insomnia (Shealy et al., 1998). Indeed, this approach alone is more effective than any antidepressant.

In 1994, I discovered that the old Electreat produced a wider range of electrical frequencies from 1 Hz to at least 80 gigaHz. The higher frequencies, 54–78 GigaHz, have been studied extensively in Russia and in the Ukraine, where quantum physicists believe that human DNA resonates at 54–78 gigaHz. In those countries, hundreds of thousands of patients have been treated with these picocurrents and frequencies via application to specific and nonspecific acupuncture points. Physicians in these countries report success rates of 50% in treating opioid addiction and up to 92% in treating rheumatoid arthritis (RA) and many other diseases, including diabetes, peptic ulcer, and angina pectoris

(Shealy, 1993). This appears to be the result of gigaHz frequencies.

Over the past 37 years, we applied at our clinic Electreat and prototypes of the SheLi TENS™ to treat more than 25,000 patients with chronic pain. Almost invariably, patients have gained greater pain relief with these devices than with any other commercial TENS. Evoked sensations penetrate deeper and travel much more diffusely in the body than any other known TENS and the relief after stimulation often is more prolonged. In 1965, shortly after the publication of Melzack and Wall's "Gate Control of Pain" (Melzack and Wall, 1965), I conceived of the idea of controlling pain by stimulation of the dorsal columns of the spinal cord. Properly done, that approach was successful but harbored too many risks to continue it.

At the same time, I began using electrical stimulation transcutaneously and began the search for a modern solid-state stimulator that was as effective as the old Electreat, which had been patented in 1919 and that originally stating on the device "Electreat Relieves Pain." Unfortunately, in the 1940s, the FDA forced the manufacturer to remove that phrase. The old catalog that came with the Electreat was folksy and filled with claims that electricity could indeed be used to treat or cure almost any ailment. I have been able to confirm many of the unusual claims. Although the modern solid-

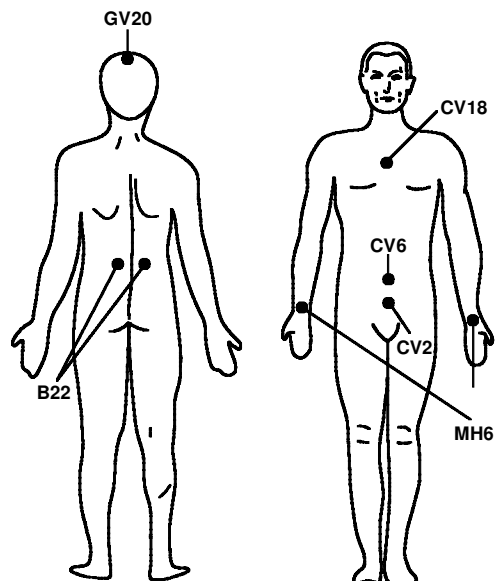
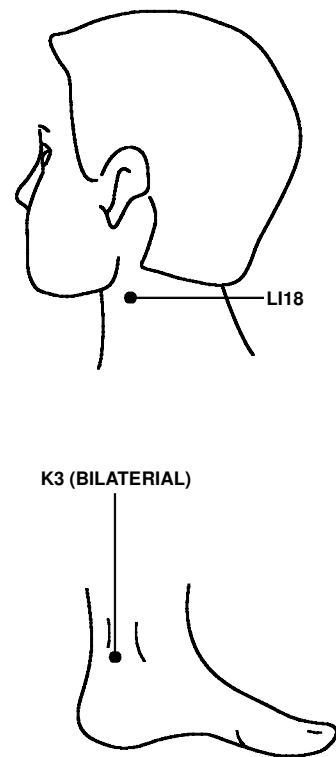


FIG. 1. The Ring of Fire.

state TENS created in the early 1970s never satisfied my requirements for efficacy, some of these devices were almost 80% effective for treating acute pain. In 1975, Saul Liss Ph.D., president of MEDI Consultants, introduced the Pain Suppressor<sup>®</sup>, which raised serotonin and beta endorphin levels.

Scores of articles now have confirmed that:

- TENS is considered to be an excellent alternative for treating acne, posttherapeutic neuralgia, psoriasis, atopic dermatitis, and urticaria (Chen and Yu, 2003).
- TENS has been used successfully for treating RA, especially affecting the hand, with a 67%-relative benefit (Brosseau et al., 2003).
- TENS produces short-lived but significant improvement in neuropsychologic or behavioral aspects of dementia (Cameron et al., 2003).
- TENS helps obese patients to lose weight and the usual dietary and exercise recommendations are made more effective (Tian et al., 2003).
- Only 6 to 10 minutes of TENS stimulation reduces itching and pain for more than 55 minutes (Nilsson et al., 2003).
- TENS is an effective adjunct for treating chronic pelvic pain from endometriosis (Greco, 2003).
- Application of TENS to the posterior tibial nerve significantly improved urodynamic parameters in an overactive or spastic bladder (Amarenco et al., 2003).
- TENS is a simple, effective, and safe method of relieving pain during hysteroscopy (De Angelis et al., 2003).
- TENS is an effective therapeutic option post-surgically for children (Sittl et al., 2000).
- TENS provides statistically significant reduction in spasticity in patients with multiple sclerosis (Armuthl et al., 2003).
- TENS may be significantly helpful in improving sensory loss after strokes (Tyson, 2003).
- TENS is statistically useful for managing osteoarthritic knee pain (Cheing et al., 2003).
- TENS is a useful therapeutic intervention for patients with multiple fractured ribs (Karmakar and Ho, 2003).
- TENS is more effective than any drug for relieving pain, especially acute pain.



**FIG. 2.** The Ring of Fire. **K3** (*Kidney*)—Midway between the tip of *medial malleolus* and *tendo calcaneus*. **CV2** (*Conception vessel*)—in the superior border of the *pubic symphysis*, on the middle of the abdomen. **CV6** (*Conception vessel*)—1.5 *cun* below the umbilicus, on the middle of the abdomen. **B22** (*Bladder*)—1.5 *cun* lateral to the lower border of the spinous process of the first lumbar vertebra. **MH6** (*Master of the heart*)—On the ulnar side of the wrist, on the radial side of the tendon *M. flexor carpi ulnaris*, below the pisiform bone. **LI18** (*Large intestine*)—1.3 *cun* lateral to the thyroid cartilage, between the sternal head, and clavicular head of the sternocleidomastoid muscle. **CV18** (*Conception vessel*)—On the midline of abdomen, 1.6 *cun* above the line of two nipples, at the level of the third intercostal rib. **GV20** (*Governing vessel*)—7 *cun* above the posterior hairline, midway on a line connecting apex of both ears.

- TENS can be effective for treating Raynaud's syndrome and reflex sympathetic dystrophy by increasing circulation (Cady et al., 1987).
- Special units are helpful in treating scoliosis (Cady et al., 1987).
- Used transcranially, TENS raises serotonin and beta endorphin levels.
- Transcranially, TENS is more effective than any antidepressant drug with a 50% success rate when used alone and an 85% effectiveness when combined with education, photostimulation, and music.
- Transcranially, TENS is extremely successful for treating insomnia and jet lag.

- Applied to specific acupuncture points TENS can raise levels of dehydroepiandrosterone (DHEA) (Shealy et al., 1995), aldosterone, neurotensin (Shealy, et al., 2002), and calcitonin (Shealy, et al., 2003); decrease free radicals (Shealy, et al., submitted for publication)\*; and be used successfully to treat 70% to 80% of patients with migraine headaches, RA, diabetic neuropathy, back pain, and depression (Cox, et al., 1996; Shealy, et al., 1996) Here the Ring of Fire points are used (Figs. 1 and 2). It has been shown that this 12-point circuit specifically raises DHEA, while stimulation elsewhere does not.
- Stimulation at the frequencies of human DNA, 54 to 78 GigaHerz, have been shown by Ukrainian physicists to be remarkably helpful for treating narcotic addiction, alcoholism, and many other conditions and several of these effects have been confirmed in our clinic (Shealy, et al., 1995), including the effect of the SheLi TENS.
- TENS has no significant "side-effects" but is not used where there is a cardiac pacemaker. TENS should be the treatment of choice for acute and chronic pain and the many other conditions listed above.

In our experience, the most efficacious devices are the Liss, Empi® (Empi, Inc., St. Paul, MN), and SheLi TENS. Our experience with the Liss in well over 25,000 patients reveals that it addresses depression successfully in 50% of patients, far better and more safely than does any antidepressant. Coupled with education, music, and photostimulation, 85% of chronically depressed patients can be treated successfully (Shealy, et al., 1995). Insomnia and jet lag are significantly improved with the use of the Liss transcranially. The most effective units at our clinic have been the Liss, standard TENS such as the Empi, and the SheLi TENS, the later for activation of acupuncture circuits; all are effective in a wide variety of clinical situations. No

pharmaceutical treatment is as safe or as effective as TENS for pain control. Indeed it is our experience that this is the most effective alternative treatment known.

## REFERENCES

- Amarenco G, Ismael SS, Even-Schneider A, Raibaut P, Demaille-Wlodyka S, Parratte B, Kerdraon J. Urodynamic effect of acute transcutaneous posterior tibial nerve stimulation in overactive bladder. *J Urol* 2003;169:2210-2215.
- Armutlu K, Meric A, Kirdi N, Yakut E, Karabudak R. The effect of transcutaneous electrical nerve stimulation on spasticity in multiple sclerosis patients: A pilot study. *Neurorehabil Neural Repair* 2003;17:79-82.
- Brosseau L, Yonge K, Robinson V, Marchand S, Judd M, Wells G, Tugwell P. Transcutaneous electrical nerve stimulation (TENS) for the treatment of rheumatoid arthritis in the hand. *Cochrane Database Syst Rev* 2003;3:CD004287.
- Cady RK, Shealy CN. Electrotherapy in medicine. *CDA Journal* June 1987;22-24.
- Cameron M, Lonergan E, Lee H. Transcutaneous electrical nerve stimulation (TENS) for dementia. *Cochrane Database Syst Rev* 2003;3:CD004032.
- Cheing GL, Tsui AY, Lo SK, Hui-Chan CW. Optimal stimulation duration of TENS in the management of osteoarthritic knee pain. *J Rehabil Med* 2003;35:62-68.
- Chen CJ, Yu HS. Acupuncture, electrostimulation, and reflex therapy in dermatology. *Dermatol Ther* 2003;16:87-92.
- Cox RN, Shealy CN, Cady RK, Cadle R, Richards G. Successful treatment of rheumatoid arthritis with gigaTENS. *Journal Neurol Orthopaedic Med Surg* 1996;17:31.
- De Angelis C, Perrone G, Santoro G, Nofroni I, Zichella L. Suppression of pelvic pain during hysteroscopy with a transcutaneous electrical nerve stimulation device. *Fertil Steril* 2003;79:1422-1427.
- Greco CD. Management of adolescent chronic pelvic pain from endometriosis: A pain center perspective. *Pediatr Adolesc Gynecol* 2003;16(suppl.3):S17-S19.
- Karmakar MK, Ho AM. Acute pain management of patients with multiple fractured ribs. *J Trauma* 2003;54:615-625.
- Kellaway P. The part played by electric fish in the early history of bioelectricity and electrotherapy. *Bull History Med* 1946;20:112-132.
- Melzack R, Wall PD. Pain mechanisms: A new theory. *Science* 1965;150:971-979.
- Nilsson HJ, Psouni E, Schouenborg J. Long term depression of human nociceptive skin senses induced by thin fibre stimulation. *Eur J Pain* 2003;7:225-233.
- Sittl R, Griessinger N, Koppert W, Likar R. Management of postoperative pain in children. *Schmerz* 2000 16;14:333-339.

\*Shealy CN, Borgmeyer V, Thomlinson RP. Reduction of free radicals by electrical stimulation of specific acupuncture points. Submitted for publication.

- Shealy CN. Transcutaneous electrical stimulation for control of pain. In: *Clinical Neurosurgery: Proceedings of the Congress of Neurological Surgeons*. Philadelphia: Williams & Wilkins, 1974:269-277.
- Shealy CN. Microwave resonance therapy: Innovations from the Ukraine. *Bull Greene County Med Soc* 1993;XLVII:15-17.
- Shealy CN, Myss CM, Cady RK, Dudley L, Cox R. Electrical stimulation raises DHEA and improves diabetic neuropathy. *Stress Med* 1995;11:215-217.
- Shealy CN, Cady RK, Cox RH. Pain stress and depression: Psychoneurophysiology and therapy. *Stress Med* 1995;11:75-77.
- Shealy CN, Cady RK, Cox RH, Murrell M. DHEA deficiency in patients with chronic pain and depression. *J Neurol Orthopaedic Med Surg* 1996;17:7-9.
- Shealy CN, Cady RK, Culver-Veehoff D, Cox R, Liss S. Cerebrospinal fluid and plasma neurochemicals: Response to cranial electrical stimulation. *J Neurol Orthopaedic Med Surg* 1998;18:94-97.
- Shealy CN, Borgmeyer V, Thomlinson RP. Intuition, neurotensin and the Ring of Air. *Subtle Energies Energy Med* 2002;11:145-150.
- Shealy CN, Borgmeyer V. Calcitonin enhancement with electrical activation of a specific acupuncture circuit. *Am J Pain Manage* 2003;13:29-32.
- Tian D, Li X, Shi Y, Liu Y, Han J. Study of the effect of transcutaneous electric nerve stimulation on obesity. *Beijing Da Xue Xue Bao* 2003;35:277-279.
- Tyson S. Use of transcutaneous nerve stimulation to treat sensory loss after stroke. *Physiother Res Int* 2004;8:53-57.

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