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5 Questions–and Answers–About Electrical Stimulation

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5 Questions-and Answers-about Electrical Stimulation

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Q: What is electrical stimulation?

A: Electrical stimulation is an established therapeutic intervention used for treating a variety of clinical problems involving the musculoskeletal, neuromuscular, genitourinary, and integumentary systems. Within the integumentary system, electrical stimulation has been used clinically for more than 3 decades to accelerate the rate of chronic wound healing.¹

For wound healing applications, therapeutic electric currents are delivered into wound and/or periwound tissue through 2 electrodes applied directly to a patient's skin. Two methods for applying the electrodes have been reported in the literature.^{2,3} The first method involves applying 1 electrode in direct contact with clean, conductive material placed in the wound while the other electrode is placed nearby on intact skin. In the second method, both electrodes are positioned on intact skin on opposite borders of the wound, straddling the lesion. Regardless of the electrode arrangement, the evidence-

based treatment protocol for low- and high-voltage stimulator devices calls for setting the pulse frequency to 100 pulses per second and setting the current or voltage to produce a moderately strong but comfortable tingling sensation in sensate skin or just below the motor threshold of insensate skin.^{2,4-7} Polarity is selected according to the cellular needs of the wound.⁸ To promote wound closure, electrical stimulation treatments are administered 1 hour per day, 5 to 7 days a week, as long as progress toward healing is being made.

Q: Electrical stimulation is indicated for what types of wounds?

A: Electrical stimulation is indicated for chronic wounds, including pressure, diabetic, arterial, and venous ulcers. Negative polarity administered to the wound by electrical stimulation increases granulation and fibroblast activity, which have been documented to facilitate wound healing.⁹ It has been reported that electrical stimulation plus standard wound care has closed pressure ulcers in spinal cord injury patients.^{3,4} In addition, negative polarity has been shown to enhance the healing of venous leg ulcers by increasing fibroblast activity⁸ and capillary density¹⁰ in patients who did not respond to standard wound care alone. Table 1 lists examples of patients with wound types for which electrical stimulation would be an appropriate treatment choice.

Table 1: Examples of Indications for Electrical Stimulation

Types of Wound/Patient History	Rationale for Use
A Patient who is quadriplegic (C-6) has a stage IV right ischial pressure ulcer with undermining (1.5 cm) that has deteriorated after 2 weeks of standard wound care alone.	Electrical stimulation can be added to the treatment program for the wound. Electrical stimulation plus standard wound care has been documented to close pressure ulcers in spinal cord-injury patients. ^{1,2} Negative polarity administered to the wound by electrical stimulation increases tissue granulation and fibroblast activity, facilitating wound healing. ³ Positive polarity promotes epidermal cell migration. ⁴
A patient with type 2 diabetes has a Wagner grade 2 neuropathic, non-tracking ulcer over the first metatarsal head of his left foot. No measurable progress has been made after 4 weeks of becaplermin therapy and offloading.	Electrical stimulation plus offloading can be used to treat this wound. Negative polarity administered to the wound by electrical stimulation increases tissue granulation and fibroblast activity, facilitating wound healing. ³ Positive polarity promotes epidermal cell migration. ⁴
A patient has a full-thickness venous ulcer on her left medial ankle. Three weeks of standard dressings, pneumatic compression, and compression bandaging have failed to promote measurable progress toward closure.	Electrical stimulation plus compression therapy can be used to treat this wound. Negative polarity administered by electrical stimulation has been documented to enhance healing of venous leg ulcers by increasing fibroblast activity ³ and capillary density ^{4,5} in patients who did not respond to standard wound care alone.

Q: When would electrical stimulation be contraindicated?

A: Electrical stimulation is contraindicated:

- for basal or squamous cell carcinoma in wound or periwound tissue
- for osteomyelitis (if not responding to systemic treatment with antibiotics)
- for ion residues of iodine or silver in the wound
- over electronic implants (pacing devices)
- over the heart.

Q: Why is electrical stimulation thought to be effective in managing wounds?

A: Ten randomized^{7,11-14} and 5 controlled^{1,10,15-17} clinical trials have shown that electrical stimulation plus standard wound care accelerates the healing rate of chronic wounds significantly faster than standard wound care alone. Mechanisms that may account for the accelerated wound healing rate include increases in capillary density and perfusion,¹⁰ increased partial pressure of oxygen,¹⁸ stimulation of protein and DNA synthesis by fibroblasts,⁹ increased wound tensile strength,¹⁹ presence of an antibacterial effect,²⁰ and galvanotaxic migration of inflammatory and/or repair cells into the wound.⁷

Q: Are different wound types managed differently with electrical stimulation?

A: Although standard care for managing different types of wounds (e.g., pressure, venous, diabetic, and arterial ulcers) is different, the only variables when treating these wounds with electrical stimulation are the need to periodically change electrode polarity and the dosage of current delivered to the wound tissues. Table 1 shows examples of the differences in polarity when treating different types of wounds.

Patients who are treated with electrical stimulation to enhance wound healing should be under the direct supervision of a physical therapist or a licensed health care practitioner who is trained to use electrical stimulation. Wound care clinicians are educated in identifying changes in the phases of wound healing and can determine when intervention with standard wound care has failed. If electrical stimulation is indicated, the physical therapist can determine the appropriate electrode polarity to facilitate a specific cellular response. This polarity can change on any given patient at any given time, depending on the factors taken into consideration when evaluating a wound.

For example, a wound may require autolysis, reepithelialization, or granulation tissue development.⁷ When electrical stimulation is used to facilitate any of these responses, a clinician trained in electrical stimulation is the best person to determine the dosage and/or polarity of the charge to be used and to assess the progress toward healing.

References

1. Wolcott LE, Wheeler PC, Hardwicke HM, Rowley BA. Accelerated healing of skin ulcers by electrotherapy. *South Med J* 1969; 62:795-801.
2. Kloth LC, Feedar JA. Acceleration of wound healing with high voltage, monophasic, pulsed current. *Phys Ther* 1988; 68:503-8.

3. Baker LL, Rubayi S, Villar F, DeMuth SK. Effect of electrical stimulation wave-form on healing of ulcers in human beings with spinal cord injury. *Wound Rep Reg* 1996;4:21-8.
4. Gentzkow GD, Pollack SV, Kloth LC. Improved healing of pressure ulcers using Dermapulse, a new electrical stimulation device. *Wounds* 1991;3:158-70.
5. Griffin JW, Tooms RE, Mendius RA, Clifft JK, Vander Zwaag R, El-Zeky F. Efficacy of high voltage pulsed current for healing of pressure ulcers in patients with spinal cord injury. *Phys Ther* 1991;71:433-42.
6. Feedar JA, Kloth LC, Gentzkow GD. Chronic dermal ulcer healing enhanced with monophasic pulsed electrical stimulation. *Phys Ther* 1991;71:639-49.
7. Gentzkow GD, Alon G, Taler GA, Eltorai I, Montroy RE. Healing of refractory stage III and IV pressure ulcers with a new electrical stimulation device. *Wounds* 1993;5:160-72.
8. Kloth LC, McCulloch JM. Promotion of wound healing with electrical stimulation. *Adv Wound Care* 1996;9(5):42-5.
9. Bourguignon GJ, Bourguignon LY. Electric stimulation of protein and DNA synthesis in human fibroblasts. *FASEB J* 1987;1:398-402.
10. Junger M, Zuder D, Steins A, Hahn M, Klyszcz T. The effects of electrical stimulation on wound healing in patients with diabetic ulcers. *Hautarzt* 1997;18:879-903.
11. Carley PJ, Wainapel SF. Electrotherapy for acceleration of wound healing: low intensity direct current. *Arch Phys Med Rehabil* 1985;66:443-6.
12. Lundeberg TC, Eriksson SV, Malm M. Electrical nerve stimulation improves healing of diabetic ulcers. *Ann Plastic Surg* 1992;29:328-31.
13. Wood JM, Evans PE, Schallreuter KU, et al. A multi-center study on the use of pulsed low intensity direct current for healing chronic stage II and stage III decubitus ulcers. *Arch Dermatolog* 1993;129:999-1009.
14. Baker LL, Chambers R, DeMuth SK, Villar F. The effects of electrical stimulation on wound healing in patients with diabetic ulcers. *Diabetes Care* 1997;20:405-12.
15. Gault WR, Gatens PF. Use of low intensity direct current in management of ischemic skin ulcers. *Phys Ther* 1976;56:265-9.
16. Karba R, Vodovnik L, Presern-Strukeji M, Klesnik M. Promoted healing of chronic wounds due to electrical stimulation. *Wounds* 1991;3:316-23.
17. Stefanovska A, Vodovnik L, Benko H, Turk R. Treatment of chronic wounds by means of electric and electromagnetic fields, part 2: value of FES parameters for pressure sore treatment. *Med Biol Eng Comput* 1993;31:213-20.
18. Mawson AR, Siddiqui FH, Connolly BJ, et al. Effect of high voltage pulsed galvanic stimulation on sacral transcutaneous oxygen levels in the spinal cord injured. *Paraplegia* 1993;31:311-9.
19. Brown M, Gogia PP, Sinacore DR. High voltage galvanic stimulation on wound healing in guinea pigs: longer-term effects. *Arch Phys Med Rehabil* 1995;76:1134-7.
20. Kincaid CB, Lavoie KH. Inhibition of bacterial growth in vitro following stimulation with high voltage, monophasic, pulsed current. *Phys Ther* 1989;69:651-5.