

# Electrotherapy

| Electrotherapy  |                        |
|---|------------------------|
| <i>Intervention</i>   |                        |
|    |                        |
| Use of electrical apparatus. Interrupted galvanism used in regeneration of deltoid muscle. First half of the twentieth century. |                        |
| MeSH  | D004599 <sup>[1]</sup> |

**Electrotherapy** is the use of electrical energy as a medical treatment<sup>[2]</sup> In medicine, the term *electrotherapy* can apply to a variety of treatments, including the use of electrical devices such as deep brain stimulators for neurological disease. The term has also been applied specifically to the use of electric current to speed wound healing. Additionally, the term "electrotherapy" or "electromagnetic therapy" has also been applied to a range of alternative medical devices and treatments.

It has not been found to be effective in increasing bone healing.<sup>[3]</sup>

## History

During 1855 Guillaume Duchenne, the developer of electrotherapy, announced that alternating was superior to direct current for electrotherapeutic triggering of muscle contractions.<sup>[4]</sup> What he called the 'warming affect' of direct currents irritated the skin, since, at voltage strengths needed for muscle contractions, they cause the skin to blister (at the anode) and pit (at the cathode). Furthermore, with DC each contraction required the current to be stopped and restarted. Moreover alternating current could produce strong muscle contractions regardless of the condition of the muscle, whereas DC-induced contractions were strong if the muscle was strong, and weak if the muscle was weak.

Since that time almost all rehabilitation involving muscle contraction has been done with a symmetrical rectangular biphasic waveform. During the 1940s, however, the US War Department, investigating the application of electrical stimulation not just to retard and prevent atrophy but to restore muscle mass and strength, employed what was termed *galvanic exercise* on the atrophied hands of patients who had an ulnar nerve lesion from surgery upon a wound.<sup>[5]</sup> These Galvanic exercises employed a monophasic wave form, direct current - electrochemistry.

## Current use

Although a 1999 meta-analysis found that electrotherapy could speed the healing of wounds,<sup>[6]</sup> during 2000 the Dutch Medical Council found that although it was widely used, there was insufficient evidence for its benefits.<sup>[7]</sup> Since that time, a few publications have emerged that seem to support its efficacy, but data is still scarce.<sup>[8]</sup>

The use of electrotherapy has been researched and accepted in the field of rehabilitation<sup>[9]</sup> (electrical muscle stimulation). The American Physical Therapy Association acknowledges the use of Electrotherapy for:<sup>[10]</sup>

### 1. Pain management

- Improves range of joint movement

### 2. Treatment of neuromuscular dysfunction

- Improvement of strength
- Improvement of motor control
- Retards muscle atrophy
- Improvement of local blood flow

### 3. Improves range of joint mobility

- Induces repeated stretching of contracted, shortened soft tissues

### 4. Tissue repair

- Enhances microcirculation and protein synthesis to heal wounds
- Restores integrity of connective and dermal tissues

### 5. Acute and chronic edema

- Accelerates absorption rate
- Affects blood vessel permeability
- Increases mobility of proteins, blood cells and lymphatic flow

### 6. Peripheral blood flow

- Induces arterial, venous and lymphatic flow

### 7. Iontophoresis

- Delivery of pharmacological agents

### 8. Urine and fecal incontinence

- Affects pelvic floor musculature to reduce pelvic pain and strengthen musculature
- Treatment may lead to complete continence

Electrotherapy is used for relaxation of muscle spasms, prevention and retardation of disuse atrophy, increase of local blood circulation, muscle rehabilitation and re-education electrical muscle stimulation, maintaining and increasing range of motion, management of chronic and intractable pain, post-traumatic acute pain, post surgical acute pain, immediate post-surgical stimulation of muscles to prevent venous thrombosis, wound healing and drug delivery.

Some of the treatment effectiveness mechanisms are little understood, with effectiveness and best practices for their use still anecdotal.

Electrotherapy devices have been studied in the treatment of chronic wounds and pressure ulcers. A 1999 meta-analysis of published trials found some evidence that electrotherapy could speed the healing of such wounds, though it was unclear which devices were most effective and which types of wounds were most likely to benefit.<sup>[6]</sup> However, a more detailed review by the Cochrane Library found no evidence that electromagnetic therapy, a subset of electrotherapy, was effective in healing pressure ulcers<sup>[11]</sup> or venous stasis ulcers.<sup>[12]</sup>

## References

- [1] [http://www.nlm.nih.gov/cgi/mesh/2011/MB\\_cgi?field=uid&term=D004599](http://www.nlm.nih.gov/cgi/mesh/2011/MB_cgi?field=uid&term=D004599)
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- [12] Ravaghi H, Flemming K, Cullum N, Olyae Manesh A (2006). Ravaghi, Hamid. ed. "Electromagnetic therapy for treating venous leg ulcers". *Cochrane Database Syst Rev* (2): CD002933. doi:10.1002/14651858.CD002933.pub3. PMID 16625565.

## Further reading

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- Nelson, Roger M.; Currier, Dean P.; "*Clinical Electrotherapy*"; 2nd ed., ISBN 0-8385-1334-4; 422 p. Appleton & Lange, a publishing division of Prentice Hall, c1991 c1987; 3rd ed., ISBN 083851491X;
- Watkins, Arthur Lancaster, "*A manual of electrotherapy*". 2d ed., thoroughly rev. Philadelphia : Lea & Febiger, c1962. 272 p.
- Scott, Bryan O., "*The principles and practice of electrotherapy and actinotherapy*". Springfield, Ill., C.C. Thomas, c1959. 314 p. LCCN 60004533 /L
- Neuroelectric Conference (1969 : San Francisco, Calif.), "*Neuroelectric research; electroneuroprosthesis, electroanesthesia and nonconvulsive electrotherapy*". Editor, David V. Reynolds and Anita E. Sjoberg. Springfield, Ill., Thomas, 1971. LCCN 75115389 (ed. Selected papers presented at the 1969 Neuroelectric Conference, the second annual conference of the Neuroelectric Society.)

## External links

- Electrotherapy on the Web (<http://www.electrotherapy.org>) Tim Watson's website on electrotherapy, containing in-depth discussion and dose calculations.
- The Turn of The Century Electrotherapy Museum (<http://www.electrotherapymuseum.com/>)
- International Journal of Electrotherapy (<http://www.electrotherapyjournal.org>) International Journal of Electrotherapy

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