

# **The Application of Transcutaneous Electrical Nerve Stimulation for the Relief of Pain**

by Julia Kidson

Senior Clinic Intern, The Anglo-European College of Chiropractic, 13-15 Parkwood Road, Boscombe, Bournemouth, Dorset, BH5 2DF.

© Julia Kidson 1997. Please refer to the Disclaimer & Copyright Notice at the end.

This document is written in Microsoft Word 7 and the latest version is available by FTP from <ftp://ftp.epemag.wimborne.co.uk/pub/docs/tens.doc>

You will also require the graphic file available by FTP from <ftp://ftp.epemag.wimborne.co.uk/pub/docs/tensuse2.gif> (28k).

Published as additional material to the Simple Dual Output TENS Unit project in Everyday Practical Electronics Magazine (March 1997 issue). The AECC is unable to reply to queries concerning either this document or the EPE Simple Dual Output TENS Unit.

Wimborne Publishing Ltd., Allen House, East Borough, Wimborne, Dorset, BH21 1PF. Last updated 13<sup>th</sup> March 1997. A web version of this document is available at <http://www.epemag.wimborne.co.uk/aecctens.htm>. Consult our Home Page for contact details and further information.

## **Introduction**

Transcutaneous electrical nerve stimulation (TENS) is a relatively inexpensive and non-invasive form of electrotherapy which uses a low frequency current (1-3). For centuries, electrical stimulation has been reputedly used for pain relief and now many health care professionals are trained in the appropriate use of TENS machines.

The intention of this excerpt is to provide you with the information required to make an informed decision whether a TENS unit may be of benefit to you and to assist with its safe use for optimal benefit.

### **PLEASE NOTE**

**TENS machines should not be used unless the cause of pain has been diagnosed/ascertained by a qualified health care practitioner.**

## **The Phenomenon of Pain and its Inhibition**

Pain is a multidimensional phenomenon and a subjective experience, involving complex physiological and emotional interactions (5). TENS attempts to modulate the mechanisms by which pain is felt. There are a number of mechanisms by which TENS machines are considered to inhibit or relieve pain.

### *Spinal gate control theory*

TENS has the ability to stimulate fast conducting nerves that travel to the spinal cord. In doing so, it essentially “beats” the slow-conducting pain carrying nerves and, therefore, overrides/prevents the message of pain from reaching the spinal cord i.e. it closes the “gate” of entry to the spinal cord. In order to close the “gate” the TENS unit must be applied close to the painful area since the nerves involved are segmentally arranged within the spinal cord and thus are intimately linked anatomically (1-4,6-10)

### *Direct inhibition of an abnormally firing nerve or damaged nerve*

A damaged nerve is said to be sensitive to slight mechanical stimuli (motion) and nor-adrenaline (a chemical utilised by the sympathetic nervous system) which in turn results in abnormal firing of the pain nerve fibres. It is considered that TENS relieves this perceived pain by directly inhibiting the electrical firing occurring at the damaged nerve ends (3,6,7,11).

### *Central biasing theory*

The central biasing mechanism is a powerful method of pain control which involves the central nervous system (brain and spinal cord). Intense stimulation of the peripheral nerves activates the complex central biasing mechanism which exerts an inhibitory influence by blocking incoming signals and an analgesic block is produced (3,6,8,9,11).

### *Endorphin Release*

Endorphins are the body's own pain killing chemicals. They bind to opioid receptors in the brain and have a potent analgesic effect. TENS is considered to be an appropriate trigger for their release (3,5,6,9,10).

### **Indications and Contraindications**

There are a multitude of painful conditions which TENS machines are thought to make more tolerable, however, it should be remembered that TENS will not cure any condition, it is purely a pain relief device. Table 1 lists a number of conditions that have been reported to respond to the use of TENS.

**Table 1.**

#### **Indications**

- Acute sprains/strains e.g. Sports injuries (1,9,10)
- Arthritis (10,12,13)
- Carpal Tunnel syndrome (1,3,13)
- Cervical spondylosis (3,9,10,12)
- Fibrositis/Myofascial pain syndromes (10,12,13)
- Labour pain (1,3)
- Low back pain (1,3,8,10,12,13)
- Osteoarthritis (3,9)
- Pain in the terminally ill e.g. Metastasis (1,3,13)
- Peripheral nerve injuries (1,10,13)
- Phantom limb pain (3,9,13)
- Post herpetic neuralgia (1,3,10)
- Post operative pain (1,3,6,9,10,12,13)
- Radiculopathy (1,9,13)
- Spinal cord disorders (1,10)
- Tendinitis/Bursitis (9,12)

The main contraindications to the use of TENS can be found in Table 2.

**Table 2**  
**Contraindications**

A TENS unit should **NOT** be used under the following circumstances:

- Where the cause of pain has not been diagnosed by a qualified health care practitioner (3,9)
- By any person with a heart pacemaker (3,6,8,9,10,12,13,14)
- By any person with a serious/unstable heart condition (3,8,10)
- By any person with epilepsy (3,6)
- When electrodes are placed across the chest, i.e. both arms simultaneously (3)
- When electrodes are placed on the neck in the region of the carotid arteries (3,6,9,12,13)
- Where any area of skin is inflamed or infected (3,9,10,12,13)
- Pregnancy (3,6,8,10,12)
- If an allergic reaction develops to adhesive tape or electrodes (1,2,3,6,8,9,13)
- Around the head (3)

**How to use your TENS unit**

**NB. Switch off appliance before applying and removing electrodes.**

1. Placement of Electrodes (*refer to the separate graphic - see Introduction*).

Before applying electrodes always ensure that the skin is clean, dry and free from grease or powder.

Placement of the electrodes in the correct position is a vital part of TENS unit utilisation. Stimulating electrodes should be positioned so that their edges are never less than 1 cm apart, so as to avoid direct conduction (i.e. short circuiting between the electrodes). Electrodes should be placed along the general direction of the nerves in the part of the body being treated. On the limbs, the electrodes are, therefore, often placed longitudinally (13). Again, it is important to seek the appropriate advice from a qualified health professional regarding the proper and most effective placement of the electrodes.

2. Set all controls to zero and set the mode switch to either the continuous or the pulsed setting depending on preference. (This may take some time to ascertain; if your TENS was successful initially but then ceases to have any effect the pulsed mode should be used to overcome adaptation and accommodation) (1,2,3,6,13).

3. Increase the amplitude control slowly to a maximum comfortable level i.e. where you can feel a strong but comfortable stimulation similar to a tingling sensation (2,14). If muscle contraction is felt or seen the amplitude is too high (12).
4. Allow stimulation for 20-30 minutes, checking electrode placement every 5 minutes initially for abnormal skin reactions, 20-30 minutes is recommended since experimentation has shown that maximum pain relief usually occurs within 20 minutes (8,11). If pain increases discontinue use.

You may get a period of pain relief after stimulation has ceased. However, don't be disappointed if relief is limited to the time the TENS unit is actually in use. If this is the case it has been suggested that the TENS unit can be utilised continuously or as required with caution (14). In such cases, electrodes must be removed from the skin every 24 hours and should not be applied to the same area of skin every day (this is advisable in all cases).

5. Before removing electrodes, ensure appliance is turned off.

Please look after your TENS unit since reasons for poor results or complications include equipment failure (see table 3).

**Table 3.**

- Failure of leads (poor quality or overuse) (3,13)
- Depletion of Battery (3,13)
- Worn Electrode pads (3)
- Dirty Electrode pads (3)

## Bibliography

1. Wall P D. The Discovery of Transcutaneous Electrical Nerve Stimulation. *Physiotherapy*, 1985; 71(8):348-350.
2. Johnson M I. Ashton C H. Thompson J W. The Clinical Use of TENS. *Journal of Orthopaedic Medicine*, 1992; 14(1):3-12.
3. Frampton V. Transcutaneous Electrical Nerve Stimulation. *Clayton's Electrotherapy IOE*, 1996; 18:287-305.
4. Mannheimer J S. Electrode Placements for Transcutaneous Electrical Nerve Stimulation. *Physical Therapy*, 1978; 58(12):1455-1461.
5. Belanger A Y. Physiological Evidence for an Endogenous Opiate-Related Pain-Modulating System and its Relevance to TENS. A Review. *Physiotherapy Canada*, 1985; 37(3):163-168.
6. Soric R. Devlin M. Transcutaneous Electrical Nerve Stimulation. *Practical Aspects and Applications,\* Postgraduate Medicine* 1985; 78(4):101-107.
7. Forster A. Palastanga N. Pain Modulation. *Clayton's Electrotherapy: Theory and Practice*, 1990:100-110.
8. Herman E. The Use of Transcutaneous Nerve Stimulation in the Management of Chronic Pain. *Physiotherapy Canada*, 1977; 29(2):65-71.
9. Bechtel T. Fan P T. When is TENS Effective and Practical for Pain Relief. How to Put Electrical Stimulation to Best Use. *The Journal of Musculoskeletal Medicine*, 1985; 2(11):37-43.
10. Wong J. Rapson L. TENS. *Manual of Transcutaneous Electrical Nerve Stimulation Therapy* 1983.
11. Melzack R. Vetere P. Finch L. Transcutaneous Electrical Nerve Stimulation for Low Back Pain. A Comparison of TENS and Massage for Pain and Range of Motion. *Physical Therapy* 1983; 63(4):489-493.
12. Lampe G N. Introduction to the Use of Transcutaneous Electrical Nerve Stimulation Devices. *Physical Therapy*, 1978; 58(12):1450-1454.
13. Thompson J W. Transcutaneous Electrical Nerve Stimulation for the Relief of Pain. *Acupuncture in Medicine* 1995; 13(1):35-40.
14. Forster A, Palastanga N. Transcutaneous (Electrical) Nerve Stimulation. *Calyton's Electrotherapy: Theory and Practice* 1990; 103-107.

15. Fried T. Johnson R. McCracken W. Transcutaneous Electrical Nerve Stimulation. Its Role in the Control of Chronic Pain. Arch Phys Med Rehabil 1984; 65:228-231.

### **COPYRIGHT NOTICE & DISCLAIMER**

This information resource is provided in the best of faith in order to offer authoritative advice as to the correct use of TENS units, but you use this information together with the EPE TENS Unit entirely at your own risk. No responsibility is accepted by the author, the Anglo-European College of Chiropractic or Wimborne Publishing Ltd. for the contents of this article and no claims for alleged injury or consequential damages howsoever caused will be accepted since standards of construction and conditions of use are beyond our control. This article and graphics may not be uploaded onto any other Internet site, commercial, educational or otherwise, nor may it be modified in any way, without the prior consent of Julia Kidson and the AECC. It may not be reprinted, resold or re-published in any other form without the express permission of Wimborne Publishing Ltd.

(c) 1997 Julia Kidson

Comments and feedback welcomed by E-mail to  
alan@epemag.demon.co.uk