# TRANSCUTANEOUS ELECTRICAL NERVE STIMULATION FOR THE RELIEF OF CHRONIC PAIN

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## SYNOPSIS

**Transcutaneous electrical nerve stimulation (TENS) is an effective and safe therapeutic modality for the relief of pain by a process of sensory modulation. Based on the pain-gate control theory of Melzack & Wall (1) this concept has been simplified into practical use for the treatment of chronic and acute pain (2). The TENS device was used in a group of patients with chronic pain syndromes arising from neurological and orthopaedic disorders and the effects evaluated according to individual patient's response. The study was conducted at the Dept. of Rehabilitation Medicine, Tan Tock Seng Hospital.**

## INTRODUCTION

### Pain

Pain is one of the most important symptoms in clinical practice. While acute pain serves a useful purpose as a diagnostic indicator, chronic pain is not only a nuisance but can cause considerable morbidity and disability which is reflected statistically and economically in loss of effective working manpower. In the USA, chronic pain costs the industries more than US$50 billion per year.

There are 2 major factors involved in pain:

1. Emotional and psychological factor
2. Physical factor

Thus the significance of the painful stimulus is affected by the attention given to the stimulus by the patient and this determines the overall response to pain. The clinician must therefore consider the emotional and rational attributes to pain when managing such a patient and psychotherapy may be required. The physical management of pain embodies 4 major techniques:

1. Medication - acting at receptor level, spinal cord level or higher CNS centres.
2. Sensory modulation - through itching, vibration, heat, massage, electrical stimulation and other counter-irritant measures.
3. Neurosurgery - by interruption of pain pathways.
4. Acupuncture.

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Table 1 Study of the Clinical Response to TENS

| No. | Patient/Sex/Age | Diagnosis | Pain Syndrome | Clinical Response |
|---|---|---|---|---|
| 1. | MBS/M/51 | CVA left hemiparesis | Left shoulder | Fair |
| 2. | AS/M/47 | Bilateral A.K. amputee | Stump pain | Good |
| 3. | ABM/M/66 | Hyperextension cervical spinal injury | Low backache | Good |
| 4. | OYL/M/32 | Hyperextension cervical spinal injury | Painful pares-thesiae upper limb | Fair |
| 5. | FRB/M/38 | Right brachial plexus injury | Pain right shoulder | Poor |
| 6. | CPF/M/25 | Fracture T12/L1 Paraparesis | Referred pain thighs | Good |
| 7. | EGS/F/63 | CVA left hemiparesis | Pain left shoulder | Fair |
| 8. | MEH/M/37 | Fracture L1 paraparesis | Referred pain right thigh | Good |
| 9 | HMC/M/61 | Lumbar spondylosis | Low backache | Fair |
| 10. | LMT/M/45 | Fracture C5 Tetraparesis | Pain left shoulder | Good |
| 11. | SN/M/26 | Fracture T12/L1 | Severe pain both feet | Good |
| 12. | YSH/M/54 | PID C5/C6 | Pain Right shoulder | Poor |
| 13. | FV/F/16 | Astrocytoma spinal cord, paraparesis | Burning pain left leg | Good |
| 14. | MBJ/M/20 | Left brachial plexus injury | Pain left hand | Poor |
| 15. | SM/M/50 | CVA left hemiparesis | Pain left shoulder | Poor |
| 16. | LKH/F/28 | Fracture L1, L2 spine paraparesis | Pain left foot | Good |
| 17. | SS/M/52 | Falx meningioma (excised) right hemiparesis | Pain right shoulder | Fair |
| 18. | MKS/M/20 | Fracture C5, Tetraparesis | Pain elbows and shoulders | Poor |
| 19. | RR/F/50 | Rotator cuff lesion left shoulder | Pain left shoulder | Good |
| 20. | TT/F/54 | Cervical spondylosis C5 Root pain | Acute pain right shoulder | Good |

**The Gate Control Therapy**

In 1965, Melzack & Wall (1) proposed a gating mechanism in the nervous system which could control pain sensation entering the spinal cord. This gate mechanism is located in the substantia gelatinosa of the dorsal horn. It acts as a spinal-gating mechanism by modulating the conduction of nerve impulses from the peripheral fibres to the transmission cells (T-cells). Thus, in order to activate the T-cells, the potentials of both fast conducting A fibres (large myelinated fibres) and slow conducting C fibres (small, unmyelinated fibres) must pass through the substantia gelatinosa. High levels of activity of A fibres "close" the gate by a positive feedback mechanism, while high levels of C fibres activity "open" the gate by a negative feedback mechanism. It is postulated therefore that selective stimulation of A fibres can alter the excitation of T-cells and the perception of pain.

**The T.E.N.S. Device**

TENS is a process of sensory modulation involving the use of low voltage or low amperage current to produce electroanalgesia by a process of differential sensory nerve excitation. Physiologically, the thicker A fibres require a phasic input for stimulation, while the thinner C fibres respond to intense prolonged stimuli. Most T.E.N.S. devices generate either an asymmetrical, biphasic or a rentangular monophasic wave form which is required to elicit the desired response in the A afferent fibres. However, the choice of wave form may be determined by individual patient preference. A frequency range of 85 - 125 c.p.s. and pulse width/duration range of 75 - 150 microseconds is necessary for effective large sensory fibre stimulation.

Table 2 Results of treatment

| | | Number | | Percentage | Dougherty 1978 |
|---|---|---|---|---|---|
| **Total patients treated =** | | 20 | - | 100% | 375 - 100% |
| Total patients with good results | = | 10 | - | 50% | 226 - 60.27% |
| Total patients with fair results | = | 5 | - | 25% | 57 - 15.20% |
| Total patients with poor results | = | 5 | - | 25% | 92 - 24.53% |

## METHOD

The TENS unit was attached to the patients by wires connected to electrodes with ultrasonic gel as a conducting medium to the skin. Results were recorded as follows (3):-

Good : Reduction in pain, increased mobility, decrease or elimination of medications.

Fair : Some reduction in pain, some increase in mobility, some decrease of medications.

Poor : Minimal or no reduction in pain, minimal or no increased mobility, no evidence of reduction of drug use.

TENS electrodes were placed either unilaterally or bilaterally, in most cases directly over sensory nerves supplying the painful area; over the painful area itself or over "trigger points". The TENS device was then turned up to a point where the patient perceived a slight tingling sensation. Patients were treated for up to 30 mins. and therapy was repeated where pain relief was not immediate and sustained.

## RESULTS

The analysis of results of treatment with TENS on 20 patients with chronic pain arising from orthopaedic/ neurological disorders are noted in Table 2. Comparing our results with that obtained by Dougherty 1978 (3), the overall number of patients with good and fair results were around 75% in both studies, with a similar proportion of poor results i.e. 25%. While no attempt can be made to objectively quantify the degree of pain it should be understood that such patients presented with severe, chronic pain due to underlying neurological or orthopaedic disability and relief of pain in the "good" and "fair" cases produced a corresponding increase in mobility and decrease in analgesic medication.

## CONCLUSION

As an alternative to analgesic medication, TENS is a practical, safe and non-invasive means of treating chronic pain and should be an essential component of a doctor's office. While there are extensive and well documented studies demonstrating positive results with TENS for the relief of pain, it is necessary for further studies to be made on local patients to substantiate such clinical findings.

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## REFERENCES

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