TENS REVISITED

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GOALS

- Understand the History of TENS
- Realize when TENS is useful/appropriate
- Modes of TENS application
- Understand how TENS works
- Electrode Placement
- Know the Contraindications for TENS
**BACKGROUND ON TENS**

- **Definition** – Application of electrical stimulation to the skin for pain control

- TENS is non invasive, non toxic, inexpensive, safe, portable, easy to use, with relatively few contraindications

- TENS has biphasic waveform, constant current

- Electricity has been used for thousands of years for pain relief; first written documentation by Aristotle

- Electrical stimulation for pain relief not fully accepted by medical field until publication by Wall and Sweet in 1967 in response to the Gate Theory of pain which was proposed by Melzack and Wall in 1965
USES FOR TENS

- Complimentary treatment to control pain used alongside NSADs, opioids, alpha adrenergic agonists (clonidine), muscle relaxants
- TENS can enable lesser doses of adjunct medication—therefore less side effects. eg: nausea, dizziness, pruritus, seen with morphine
- Pain–immobility cycle broken with TENS pain relief, so reduced hospital stay, active exercise programme, ADLs and RTW can occur
- TENS used for acute setting with post operative and post trauma pain as an adjunct to medication. Gives earlier mobilisation, more effective breathing/coughing, earlier disch
- TENS used for chronic intractable pain, eg: RA, OA, myofascial pain, diabetic neuropathy, low back pain, phantom pain, raynauds disease, ischaemic pain
TYPES OF TENS

- **Conventional TENS**: High frequency 2–200Hz
  Low Intensity (width) 10–30ms
  No muscle contraction, sensory effect only, buzzing sense
  Analgesia wears off quickly once TENS stopped

- **Acupuncture Like TENS**: low frequency 1–4Hz
  High Intensity 150–250ms
  Produces muscle contraction, flicking sense
  Analgesia takes longer to produce but is of longer duration
  as opioids are released

- **Burst TENS**: High frequency, low intensity with
  intermittent surges of 9 pulses at 150hz so no tolerance build
  up to TENS. Beating sense

- **Modulated TENS**: delivers varying pulse rate and width
  to prevent nerve accommodation to TENS
TENS Modes

Traditional TENS (Hi TENS, Normal TENS)

Normal (Traditional) TENS using stimulation at a 'high' frequency typically between 90 - 130 Hz (pps)

Modulation Mode TENS in which the stimulation pattern is varied in order to reduce nerve accommodation. Different modulation methods include:
(A) INTENSITY
(B) PULSE DURATION
(C) FREQUENCY

Acupuncture (Low frequency or ACUTENS) TENS using stimulation at a 'low' frequency typically between 2 - 5 Hz (pps)
HOW TENS WORKS

- **Pain Gate Mechanism:** Transmission along slow conducting small diameter Adelta and C fibres is blocked by TENS stimulation along faster conducting large diameter Abeta fibres which closes the gate on the Adelta and C fibres thus preventing pain messages from being received at higher levels. Conventional TENS acts on the gate control theory.

- **Endogenous Endorphin System:** TENS stimulates the Adelta fibres which activate the production of endorphins/encephalins in the spinal cord and midbrain via descending pain inhibitory pathways. These endorphins interact with receptors blocking the perception of pain. AL TENS stimulates the Adelta fibres which acts on the opioid mechanisms so has longer effect. BURST TENS works on both Gate theory and Endorphin release theory.

- **Modulation of Descending Pathways:** at supraspinal sites can be controlled by TENS– reducing pain.
No pain


Melzack and Wall’s 1983 Revised Gate Control Theory. (From Bonica,³ p 10, with permission.)
ELECTRODE PLACEMENT

- Variable possibilities depending on the clinical setting:
  - Local to the site of pain
  - Over the Dermatome, with or without a corresponding electrode at the relevant spinal segment level
  - Following the course of the peripheral nerve
  - On acupuncture, trigger or motor points
  - Ipsilateral or contralateral
  - Electrode surface equal or greater than one inch
  - Do not place electrodes too close to each other– gap wider than the width of an electrode
  - Good contact between electrode and skin– plenty of gel
  - Change set up if skin irritation develops
LOCATIONS OF THE MOTOR POINTS
CONTRAINDICATIONS

- Undiagnosed pain
- Patients lacking cognitive ability/language barriers
- Cardiac pacemakers or other implanted electronic device
- Myocardial disease or arrhythmias without proper monitoring
- TENS may interfere with electronic monitoring equipment eg: ECG
- Electrode placement over carotid sinus, anterior neck or eyes
- Avoid open wounds, eczema, dermatitis
- Allergic response to electrodes, gel, tape
- Pregnant pelvis, lumbosacral area, trunk or abdomen
- Over area of DVT
- Patients with epilepsy
- Avoid active epiphyseal regions in children
- Do not use TENS while operating potentially dangerous equipment, eg: driving car in case abrupt change in stimulation causes startle
Clinically patients find TENS helpful for pain relief and function when reporting subjectively. Meta analyses (Michael Johnson, 2007)

Extensive yet conflicting literature. Evaluating research difficult because of shortcomings on clinical research design.

Difficulty with: An equivalent placebo
  Randomising in RCTs
  Double blinding

Confounding Variables: characteristics of TENS application, characteristics of population, characteristics of the disease, methodological considerations, variance in outcome measures.

Work on animal models by Kathleen Sluka (2003) to gain more consistency in research.
References

References