TENS Application in Palliative Care

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Objectives

- To understand the rationale for use of TENS in palliative care
- To be aware of the contraindications / precautions
- To understand the machine parameters and mechanism of action in order to select appropriate TENS settings / modes
- To be able to safely apply TENS and instruct patients in its use
- To briefly review the evidence base for TENS in cancer

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What is TENS?

- **T** ranscutaneous
- **E** lectrical
- **N** erve
- **S** timulation

- A non-pharmacological method of pain relief

- Excitation of sensory nerves by an electrical impulse applied across the skin

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TENS machine

- Small handheld battery operated device – delivers an electrical current via electrodes which are applied to the skin
- TPN 200 plus
- Pack consists of TENS unit, 9V battery, TENS lead, self-adhesive electrodes, instruction manual

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TPN200 Plus
Novacell
Super Heavy Duty
Mercury & Cadmium Free


100 150 190
70 220
50 240
30 260
(µS)
PULSE WIDTH
MODE
B C M
45 70 95
25 115
8 130
2 150
(Hz)
PULSE RATE
Mercury & Cadmium Free

OFF
1 2 3 4 5 6 7 8
OFF
1 2 3 4 5 6 7 8

Benefits of TENS

- Portable
- Easy to use
- Inexpensive
- Gives patients autonomy
- Non-invasive
- Few contraindications
- Few side effects
- Widely available
- Can be used for acute or chronic pain
- Suitable for home use

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Indications for Use of TENS in Palliative Care

- TENS can be used for disease-related pain
  - Local
  - Visceral
  - Neuropathic pain
- Can also be used for other underlying causes of pain
  - Musculo-skeletal pain e.g. osteoarthritis, back pain, soft-tissue injuries etc
- Evidence for use in both acute and chronic pain conditions

Contraindications

- Implanted electronic devices e.g. pacemaker
- Actively bleeding tissue
- Active DVT
- Impaired cognition – unable to follow instructions
- Impaired sensation (skin test)
- Allergy to electrode/tape adhesive or gels
- Do not apply TENS to:
  - Anterior neck (carotid sinus)
  - Head
  - Reproductive organs
  - Eyes
  - Regenerating nerves
  - Active epiphyseal regions in children

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Local Contraindications

- Avoid application to trunk, abdomen or pelvis during pregnancy
- Avoid application to chest in patients with cardiac disease, heart failure, arrhythmias
- TB
- Recent radiotherapy (in the past 6 months)
- Infection
- Damaged skin – wounds, eczema, dermatitis etc

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Precautions

- Local circulatory insufficiency – ensure ischaemic pain not exacerbated
- Devitalised tissue
- Epilepsy – consult relevant medical practitioner

TENS and Cancer

- All electrotherapy modalities have the theoretical potential to increase cell division rates and therefore promote tumour growth
- It is a widely held belief that electrotherapy devices are contraindicated for use over an area of malignancy
- Some modalities present a higher risk e.g. ultrasound, laser and pulsed short wave
- TENS is likely to be lower risk
- In palliative care we need to weigh up whether then benefit of improved pain control outweighs the potential / theoretical risk of increased cell division rate – consider quality of life, whether a tumour is being actively treated etc
- Informed consent is key

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Pain Mechanisms

Nociceptive system:

- **Aδ fibres** **-**transmit rapid, sharp, localised pain
- **C fibres** **-**transmit slow, diffuse pain

- These fibres synapse in the dorsal horn of the spinal cord with secondary afferent neurones

- 2 main ascending tracts from the spinal cord:

  - Spinothalamic
  - Spinoreticular

- Travel to the cortex via thalamus (spinothalamic) and brainstem and thalamus (spinoreticular)

Pain Relief Mechanisms

- **Pain Gate Mechanism** – Melzack & Wall 1965
  - Activation of larger diameter Aβ sensory fibres reduces transmission of noxious stimuli from the C fibres
  - The Aβ fibres are stimulated at relatively **high frequencies** (80-130 Hz)
- **Endogenous opioid system**
  - Release of the endogenous opiate encephalin in the spinal cord
  - Stimulated by activation of the Aδ fibres
  - Aδ fibres are stimulated at **low frequencies** (2-5 Hz)

TENS Machine Parameters

3 variables to control:

- **Output intensity** (0-80 mA) = strength of the sensation - controlled by the patient by way of a dial on the top of the machine
- **Pulse frequency** = how many pulses of electrical energy are delivered per second (pulses per second / Hertz)
- **Pulse width** = the duration of each pulse (microseconds - µs)

Conventional TENS

- **High frequency – 80-130 Hz** (an 'ideal' frequency has not been defined – may vary from patient to patient)
- **Pulse width ~ 200 µs** identified as most effective
- 'normal' intensity – strong but comfortable sensation (no muscle contraction)
- 30 minutes duration minimum to gain effect
- Analgesic effect occurs during stimulation with little carryover once machine turned off

Acupuncture–like TENS

- **Low frequency (2-5 Hz)**
- **200 – 250 µs pulse width**
- Higher intensity / stronger sensation / muscle contraction (may not be as well tolerated)
- Minimum 30 minutes to gain effect
- Takes time for opioid levels to build up therefore onset of pain relief may be slower than conventional TENS
- Carryover may last several hours

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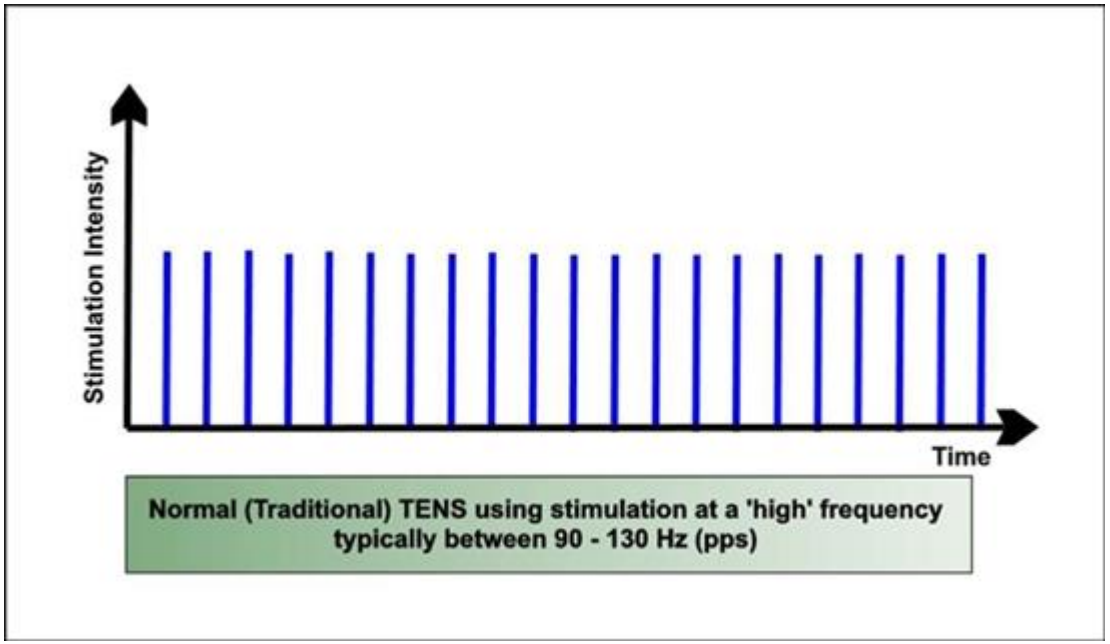
Mode options

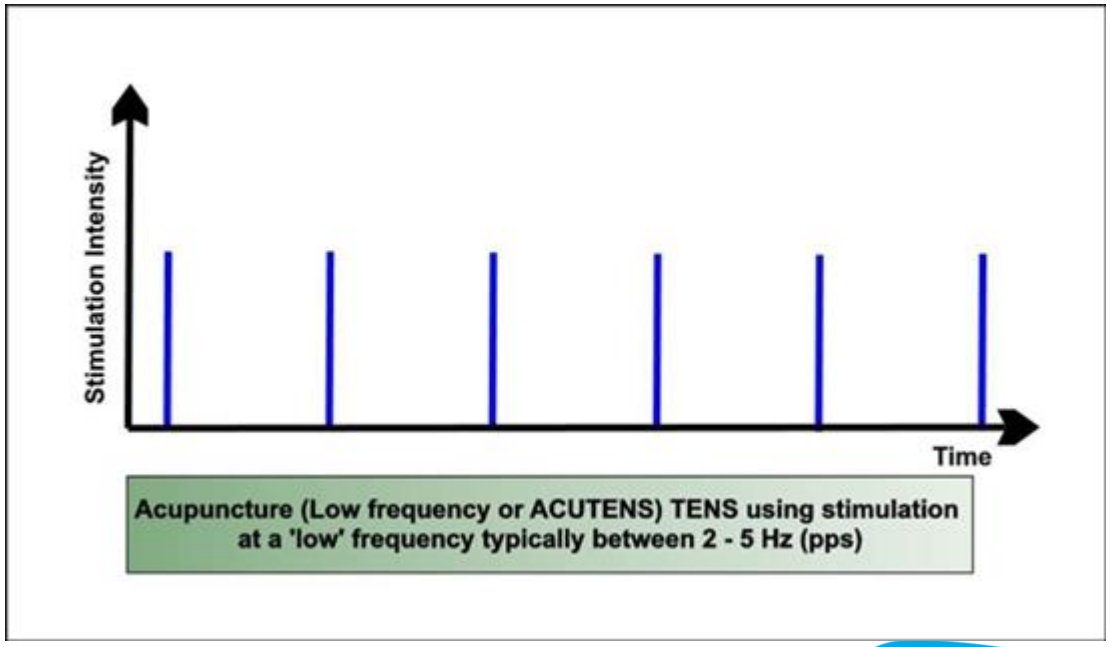
- **Continuous** – regular pulses – conventional / high frequency TENS



www.electrotherapy.org/modality/transcutaneous-electrical-nerve-stimulation-tens

Modes

- **Continuous** – acupuncture-like / low frequency TENS



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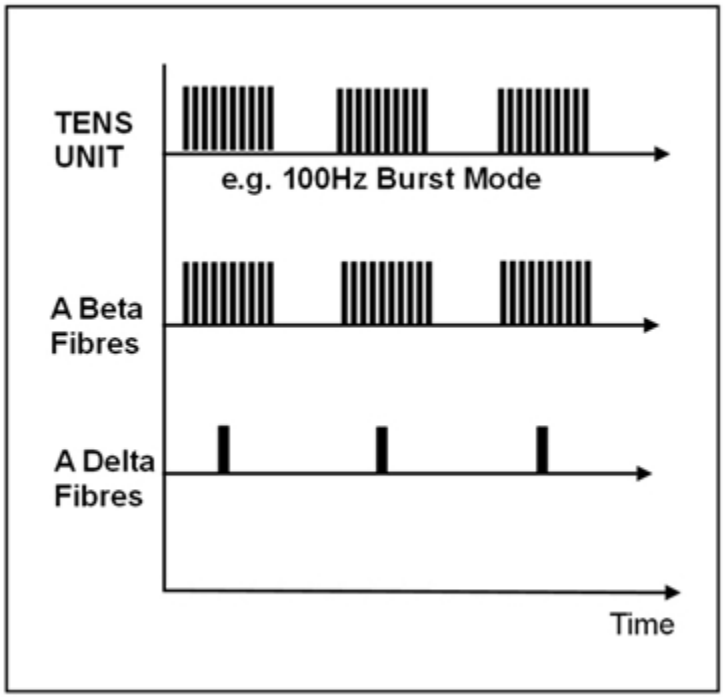
Modes

Burst

- Thought to stimulate both the pain gate and opioid system at the same time
- Used with conventional TENS settings



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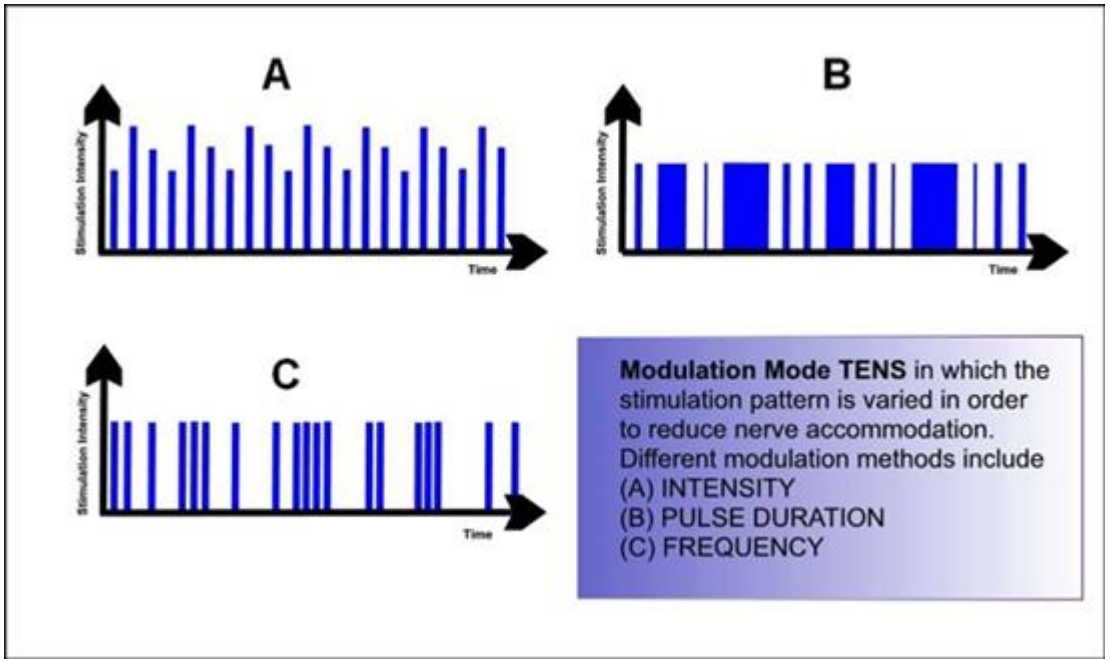
Modes

Modulation

- Irregular pattern of stimulation
- Reduces accommodation effect



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Electrode Positioning

- **Can often require a ‘trial and error’ approach**
- **Either side of the painful area (most common)**
- Applied at nerve root level to stimulate relevant dermatome
- Over peripheral nerves where they run superficially
- Motor points / trigger points / acupuncture points

Electrode Positioning

- Often a single channel is used with 2 electrodes positioned either side of the painful area
- For large areas of pain or vague / diffuse pain 2 channels with 4 electrodes can be used
- 4 electrodes also useful for localised pain with referred pain (e.g. low back pain with sciatic pain)

Application of TENS

- History and examination to assess site, cause and severity of pain
- Check contraindications / precautions
- Skin test (sharp / blunt) – electrodes need to be applied over an area of skin with normal sensation
- Set up machine – insert battery, set pulse frequency and pulse width (generally start with conventional TENS = high frequency), attach leads to the electrodes and then attach leads to the machine
- Clean skin prior to application of electrodes to improve adherence and conductivity (ensure skin is dry before application)
- Position self-adhesive electrodes on chosen area

Application of TENS

- Turn on the TENS machine and gradually turn up the intensity (using the dial) until the patient can feel a **strong but comfortable sensation** (for conventional TENS)
- Advise patient to trial for 30 mins – 1 hour (if tolerated)
- Advise patient to turn up intensity during treatment session as required in order to maintain strong sensation
- Monitor skin for redness / reaction to adhesive on electrodes
- Monitor pain levels (? Numerical rating scale 0-10 / pain diary)

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Application of TENS

- We generally advise patients to try up to 4 treatment sessions per day (each session lasting one hour)
- Time treatments to coincide with periods of activity or worst pain
- Should not sleep with TENS but can be used prior to going to bed then removed
- Patients can be ambulant when using TENS but should avoid water and not drive / operate machinery with TENS in situ
- Electrodes are single-patient use but can be used multiple times by the same person – remove and stick back onto plastic backing when storing to prolong life

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Application of TENS

- When reviewing success of the TENS trial consider the fact that there are many variables that can be altered:
  - Electrode position
  - Pulse frequency and width
  - Mode: continuous vs burst vs modulation
- Alter one variable at a time and monitor impact

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Evidence Base

2009 Cochrane Review:

- **Robb et al, Transcutaneous Electric Nerve Stimulation (TENS) for Cancer Pain (Review)** *Cochrane Database of Systematic Reviews* 2009, Volume 37, Issue 4.
- Selection criteria: RCTs investigating TENS use for cancer-related pain in adults
- 37 possible studies found via search strategy
- Only 2 studies met criteria for review = total of 64 participants
- 1) No significant difference between TENS and placebo in women with chronic pain secondary to breast cancer treatment
- 2) No significant differences between acupuncture-type TENS and sham in palliative care patients (study underpowered)
- Overall, results inconclusive due to lack of suitable RCTs

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Evidence Base

Cochrane review updated 2012

- **Hurlow et al. Transcutaneous electric nerve stimulation (TENS) for cancer pain in adults.** *Cochrane Database of Systematic Reviews* 2012, Issue 3.

- 1 additional study (2010) – 24 participants

- TENS may improve bone pain on movement in cancer patients

- This was a feasibility study and was not designed to specifically determine the impact of TENS on pain

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Evidence Base

- Searle et al, **Transcutaneous electrical nerve stimulation (TENS) for cancer bone pain**. *Journal of Pain and Symptom Management* 2009 vol 37 (3)
- Case study: 63 year old woman with metastatic lung cancer
- Upper arm pain form bone mets in proximal humerus
- Conventional TENS applied over upper arm (200 µs pulse width, 80 Hz frequency)
- Pain levels both at rest and on movement were assessed at:
  - Baseline
  - 30 minutes into treatment
  - 60 minutes into treatment (TENS then switched off)
- Results:
  - Pain at baseline was 4 at rest and 7 on movement (NRS)
  - At 60 minutes this had reduced to 1 at rest and 2 on movement
- Conclusion: TENS may help cancer bone pain, especially during movement

Evidence Base

- Siemens et al, **Transcutaneous electrical nerve stimulation for advanced cancer pain inpatients in specialist palliative care – a blinded, randomised, sham-controlled pilot cross-over trial** *Supportive Care in Cancer (2020)*
- 2 groups: intensity-modulated high TENS (IMT) versus placebo TENS (PBT)
  - IMT modulated mode 100 Hz - patients able to control intensity dial
  - PBT continuous mode 100 Hz – fixed intensity
- Small study number N=20
- No defined area of application, included different cancer types and sites of pain
- Conclusion: TENS is safe but IMT unlikely to offer more analgesia effects than PBT; 50% of patients reported at least “slight pain relief” from PBT

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Evidence Base

- Overall, there is a lack of evidence to support the use of TENS in palliative care
- This is mainly due to the lack of large well-designed RCTs
- New studies underway looking at TENS in cancer pain and TENS in liver cancer pain
- Anecdotally, clinicians report case studies of patients responding well to TENS
- As it is an inexpensive, easy to use and relatively risk free treatment it should still be considered as a treatment option, especially in patients who do not tolerate drug treatments well

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Any Questions?

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