Electrical Stimulation for Analgesia

“Sensory Analgesia”
Pain Relief?

- **Anesthesia** - Partial or complete loss of sensation with or without loss of consciousness
- **Analgesia** - Relieving pain, being in a state without pain
Pain and Electrical Stimulation

Pain Definitions

- “a distressing feeling due to disease, bodily injury or organic disorder.”
- “...uneasiness of mind or grief.”
Pain and Electrical Stimulation

Pain Definitions

- Webster’s
  - Identifies 2 distinct components to pain
    - Physical
    - Psychological
  - Both need to be addressed
Pain and Electrical Stimulation

➢ Cultural Influences
  ➢ Stereotypes may apply to limited degree
    ➢ Vocal pain sufferers
    ➢ Stoic pain survivors
    ➢ Those who deny pain despite obvious injuries
Learned responses

- ...childbirth as an example
  - “a part of life”
  - OR
  - “the most painful experience a human can survive”

- One’s culture plays a huge role that cannot be ignored
Assessment Techniques

- Pain is an individual experience that can only be described by the individual who is experiencing it
- Pain quality can be assessed only by the patient
Visual Analog Scales

- A 10 cm line is given to a patient
  
  ![Visual Analog Scale](image)

  No pain  Severe pain

- The patient is asked to mark the line to correspond with the amount of pain that they are experiencing

- The distance from the beginning of the line is then measured and recorded
Visual Analog Scales
- The patient is given a new line to re-assess their level of discomfort (after Rx)
- The distance is measured, recorded and compared with the pre-Rx distance
Pain and Electrical Stimulation

- **Pain Scales**
  - “on a scale of ‘0’ to ’10’....”
    - Patients assign a number to their discomfort
      - Patients may arbitrarily set goals for themselves
      - Patients may not be truthful in reporting successes
Pain and Electrical Stimulation

- Anatomical Pain Charts
  - Need anterior, posterior, lateral and medial views
  - May be too difficult for a patient to understand
Pain and Electrical Stimulation

- Acute Pain
  - Characteristics
    - Easily localized
    - Serves a useful purpose
    - A Delta nerve fiber stimulation
    - Quick pain, easily relieved
      - What do you do to relieve acute pain for yourself?
Chronic Pain

- Characteristics
  - Poorly localized
  - Potentially no useful purpose
  - C-fiber stimulation
  - Slow, achy pain perception
Pain and Electrical Stimulation

- Transcutaneous Electrical Nerve Stimulation (TENS)
  - Rationale and Neurophysiology
    - Gate Control Theory
      - Stimulation of large diameter A Beta fibers will block C fiber transmission and stop pain transmission to the brain
Pain and Electrical Stimulation

- **TENS**
- **Sensory Pathways**
  - Sensory stimulation of A Beta fibers with electrical stimulation will act in the dorsal horn of the spinal cord to inhibit C fiber transmission to higher centers
  - The stimulation can be comfortable to the patient
  - The information travels along the lateral spinothalamic tract
TENS

- Noxious Stimulation
  - Short treatment time with C fiber stimulation can elicit the release of endogenous opiates
  - Resulting in long lasting pain relief
Short duration C fiber stimulation with ES can elicit the release of neuro-chemical transmitters and endogenous opiates, which can provide long lasting analgesia.
Noxious Stimulation

- Activation of the anterior pituitary
  - release of a large molecule which breaks down into:
    - Beta Endorphin
      - systemically modulated 6-8 hours of pain relief
    - Cortisol
      - systemic anti inflammatory responses
Parameter Selection

- Dependent upon the desired mechanism of action for pain relief
  - Comfortable tingling
  - Uncomfortable burning or throbbing (but only for a few seconds at a time)
TENS

- Pre-synaptic Inhibition at the Dorsal Horn
  - Enkephalin interneuron
  - Central Biasing Mechanism
    - Your approach can make or “break” your success!
Parameter Selection

- dependent upon the patient’s
  - tolerance
  - patience
  - previous history with treatment techniques utilizing electrical stimulation
Goal accomplishment will be based upon the appropriate selection of
- Parameters
- Electrode placement sites
  - Check this out....
Electrode Placement

- Parallel vertical
  - “2 channels are better than 1” providing more sensory stimulation
  - If the channels are parallel to the painful site, and vertically arranged, then the patient will feel the sensation parallel to the site, not “through” the painful region
  - how about labor & delivery?
TENS

- Vertical parallel

CH 1

Ch 2

CH 1

Ch 2
If your knee hurts, do you try to make it feel better by rubbing above it, below it or all over it?
Parallel Horizontal
Myotomes

Those muscles innervated by a particular spinal nerve root
Stimulation along a myotome may provide relief in the innervates muscle if stimulation in the muscle is not possible or tolerated by the patient.

- Herpes Zoster, Phantom limb pain, reflex sympathetic dystrophy (RSD)
- (Chronic conditions)
Dermatomes

- Those areas of skin that are innervated by a spinal nerve root
- Stimulation along the nerve root may provide relief in the innervated area if stimulation in the area is not possible
- acute conditions
Scleratomes

- Those areas of bone that are innervated by a spinal nerve root
  - Stimulation along the nerve root may provide relief in the innervated area if stimulation in the area is not possible
  - Terminal chronic
Chronic pain syndromes

- May have pain referred out of the primary pain site
- The referral area **must** be included in the stimulation area in order for the patient to feel pain relief throughout the painful region and the referral area
If you rub your knee to make it feel better, you will have a tendency to rub a larger area than just the injured spot.

Instinctively you provide more sensory stimulation to accomplish pain relief.
TENS

- Criss cross electrode placement
Electrically Active Areas

- Current follows the path of least resistance

**Diagram:**
- Electrical Shock
  - The body becomes part of an electrical path.
- Broken Terminal
- Line-to-ground fault energizes metal parts.
- 1000 Ohms
  - $I = \frac{E}{R}$
  - $120V/1000\Omega = 120 \text{ mA}$
- Grounded Object or Surface
Motor Points

- Area where the motor end plate enters the muscle
- Where it requires the least amount of current to elicit a muscle contraction
- Area with low impedance
- Area with low resistance
Electrically Active Areas

- Trigger points
  - Areas that cause pain to travel when palpated
  - Area with low impedance
  - Area with low resistance
  - Identified and mapped by Janet Travell, MD whose father was a missionary in China for 20 years............
Acupuncture Points

Areas on the body first mapped by “The Yellow Emperor” as relieving pain and other conditions
Acupuncture Points

- utilize a body measurement system
  - Based upon your body size and the body inch
Electrically Active Areas

- Located on ‘meridians’ throughout the entire body
  - Similar to ‘streets’
  - Areas with low impedance
  - Areas with low resistance
Electrically Active Areas

- 1200 Old Trenton Rd.
  - MCCC’s address

- Large Intestine 4
  - Address for Ho Ku, master point for pain above the diaphragm
Indications for TENS

- Acute or chronic diagnosed pain syndromes
- Adjunctive treatment technique that treats the symptoms NOT the cause for the problem
## Modes of Stimulation

<table>
<thead>
<tr>
<th>Mode</th>
<th>Rate</th>
<th>Pulse Duration</th>
<th>Sensation</th>
<th>Electrodes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conventional</td>
<td>70-120 pps</td>
<td>short</td>
<td>tingling</td>
<td>2 channels, AP, TP crossed</td>
</tr>
<tr>
<td>Brief Intense</td>
<td>70-120 pps</td>
<td>Long 200+usec</td>
<td>Strong tingling</td>
<td>Local channel, AP, TP linear</td>
</tr>
<tr>
<td>Low Rate</td>
<td>2-4 pps</td>
<td>Long 200+usec</td>
<td>Strong muscle twitch</td>
<td>Bilateral channels on MP and AP</td>
</tr>
</tbody>
</table>
Safety Considerations with all forms of ES

- Let the patient know
  - What to expect
  - How long it will take
  - What it will feel like
  - When to call for assistance
  - How to call for assistance
  - That it’s not a good idea to move the electrodes, dials, or equipment
Contraindications

- Pregnancy
- Pacemakers
- Cognitive impairment
- Unstable fractures
- Insensate areas
- Gonads & eyes
- Malignancies