Electrotherapeutics – Transcutaneous Electrical Nerve Stimulation
Reading: Cameron chapter 13

Pain – Quick Review of Peripheral Neuro and causes

a. Sensory Nerve fibers that transmit pain: know order of lowest to highest threshold to depolarization & greatest to least myelination.

**A delta:** play strong role in the true sensory aspects of pain. (eg. Acute Pain) but are not clearly known to have a role in the emotional/psychological aspects of pain. They are responsive to all types of stimuli (mechanical, chemical, thermal). **A delta** nerves in muscle are also activated by contraction and may transmit more than pain information.

**C fibers** are unmyelinated sensory nerves and are also responsive to 3 forms of painful stimulation: thermal, mechanical, and chemical; appear to equally responsive.

b. Types of pain

**Acute Pain** - brief, sharp, intensity & duration accurately described; A delta fibers transmit; usually lasts while the stimulus is present.

**Chronic Pain** - description variable or ambiguous; emotional/psychological component likely to have developed; classified as lasting past the normal time of healing; tissue inflammation can still be present; no specific timeframe attached to this phase other than general expectation for average healing time of tissues. C fibers transmit.

NOTE: the terms **acute, subacute, & chronic** are also often used to describe time periods for stages of tissue recovery; these may not correlate well with the type of pain occurring.

Pain-Spasm-Pain cycle: (acute pain)

Tissue injury and acute pain causes the release of chemicals such as histamine, substance P and bradykinin that induce muscle guarding and spasm. The spasm causes a decrease in blood flow in the region resulting in the build-up of these chemicals, (they can't be quickly removed) causing more pain, more spasm. Also, decreased blood flow results in decreased oxygen and nutrition to tissue, causing tissue irritation, more pain, more spasm. Many treatments are designed to help break this cycle (ice, heat, massage, stretching, electrotherapy, etc.).

Measurement of Pain: Review

I. Brief Review of Pain Measurement

a. Subjective Description
   • Bodychart Pain Drawing

b. Attempting to Objectify or Quantify Pain: Rating Scales
   • Visual Analog Pain Scale (VAS); 10 cm line
   • Verbal Pain Rating/Ranking Scale (numerical or categorical)
     Verbal: “On a scale of 0 to 10: over the past 24-hours, how bad has your pain been?” OR “On a scale of 0 to 10: on average over the past 2-days, how bad has your pain been?”
   • The P-4: 4-item Pain Intensity Measure
THEORIES OF PAIN CONTROL MECHANISMS

ASSUMPTIONS
a. These concepts involve OVERLAPPING PROCESSES that occur normally in the human nervous system.
b. Use these to better understand pain perception and as a rationale for your direct interventions for pain control

STIMULATION OF MECHANORECEPTORS
a. Accomplished everyday by:
   - Rubbing a painful area; “Walking off” the pain
   - Stimulation of mechanoreceptors should be at the same neurological level as the pain.
   - Stimulation of A-beta fibers does control the pain to some degree, BUT HOW ????????

Endogenous Opiates Theories
   • Key neurotransmitters are: Enkephalin, Endorphin, Serotonin, Substance P
   • Binding of endogenous opiates to receptor sites inhibits transmission of “pain signals” to the brain.

Theory 1: Presynaptic Inhibition @ the Dorsal Horn (GATE CONTROL): one of the endogenous opiates theories. No need to memorize illustration - just make sense of the process and correctly identify a description of it (in comparison to other theories)

Gate Control / Presynaptic Inhibition: Clinical Application
   • massage, heat, ice, pressure, exercise, stretching, manual therapy
   • TENS: rapid stimulation of large afferents by using
     - High Frequency
     - Short Pulse Duration (width)
     - Sensory amplitude
   • Called Conventional / High Freq TENS
   • Ideal for acute pain (acute)

Descending Inhibition of Pain Theories (2)
   • Pain signals transmitted to the Periaqueductal Gray (PAG) & Raphe Nucleus in the brain.
   • Descending neurons are stimulated to release serotonin.
   • Serotonin causes inhibitory SC interneurons to release enkephalin – resulting in presynaptic inhibition (gate control)
Theory 2: Descending Inhibition of pain via PAG & RN

Theory 3: Inhibition of pain by Endorphin (also descending)

Descending Inhibition & Endorphin: Clinical Application
- Aggressive/noxious - massage, ice, pressure, exercise, stretching, manual therapy
- TENS - activate small afferents; A delta & C fibers
  - Low Frequency
  - Long (high) pulse duration
  - High Amplitude; uncomfortable
- Called Low Freq / Acupuncture-like TENS
- Targets chronic pain
COUNTER-IRRITANT THEORY

- Old concept - “brain gives preference to most prominent sensations”
- Many creams & rubs such as Ben-Gay, Icy-Hot, Mineral Ice, Atomic Balm, Cramergesic, and many “liniments” are classified as “counterirritant creams”; but think about how the application and the active ingredients CAN TRIGGER actual pain control mechanisms.

Treatment of Pain with TENS

NOTE: TENS Modes of Rx handout contains very important info on clinical use of TENS and is heavily emphasized in lab (and lecture)

TENS Devices: Parameters you must master for High Freq & Low Freq TENS

- Amplitude
- Frequency
- Duration / Width
- Modulations - to delay the onset of accommodation
- Electrode Placement
- Patient Instruction in home use

Modulations available with most TENS units

- Illustration of common modulations: Burst, SD mode, MR, MW, etc..
- Purpose - to delay the onset of accommodation to allow for prolonged use of TENS device; does not prevent accommodation, only delays it.
- Which modulation is best? - - It is totally patient dependent but it is OK to use a modulation mode regardless of type of pain treating;

Electrode Placement Rationales: (Where to place the electrodes to best control pain)

- On & over the area of pain
- Surround the area of pain (pass e-stim through the area of pain if you can't get on & over it)
- Arranged away from the site of pain to depolarize the nerve(s) that supply the area of pain:
  - Stimulate the peripheral nerve carrying the pain stimulus (very much a possibility IF the nerve is superficial & proximal to the pain)
  - Stimulate the nerve plexus carrying pain stimulus (rare & only possible at brachial plexus)
  - Stimulate an area within the same dermatome (skin innervation) or myotome (muscle innervation) as the area of pain.
- Acupuncture points

TENS for Pain: Knowledge you must convey

- Sensory fibers activated
- Pain control theories utilized
- Timeframe for pain control
- Treatment time
- Applicable to what type of pain?

Evidence for the Efficacy of TENS

- Doubts regarding efficacy - lack of research AND/OR conflicting evidence.
  Controversy remains; some studies have been favorable for TENS, some not; results seem to vary due to the design of the study & methodology used (issues such as randomization, control variables, treatment parameters, data collection methods, stats used).

4
Regarding TENS: "Perhaps the single largest challenge is the education, or lack thereof, provided to health care practitioners prescribing these devices and instructing patients in their use. Many professionals simply give the unit to a patient minimal instruction, leaving each device as a hit or miss item. TENS devices must be tried at a variety of settings and electrode placements to achieve optimal pain relief for a given patient. The other problem is the wide variety of technologies available. There are hundreds of different models of TENS devices in the marketplace. Most health care practitioners have received little or no background training in electrophysiology or electrical technology. Practitioners are often overwhelmed when meeting an equipment sales representative. Purchase decisions are frequently made based on lack of knowledge, misinformation, unsubstantiated claims, or price."

- **KEY FACTOR** to difficulty studying the efficacy of TENS - - a complex variable - - PAIN.
- Studies do show a potential PLACEBO effect.
- Ramifications - challenges in reimbursement; concerns regarding quality and cost of care; currently not a hot area of research.

**TENS - Tips for application in patient care**

- When applying TENS, feel free to make various adjustments in electrode placement and use varying settings of width, rate, & amplitude within reasonable limits of the mode you are using (High freq mode, Low Freq mode, etc.). DECISION MAKING MUST BE DONE ABOUT ELECTRODE PLACEMENT AND WHAT PARAMETERS GIVES THE BEST PAIN CONTROL.

- Realize that you can adjust the basic parameters (amplitude, width, or rate) to deal with accommodation, even though the modulation modes are better at delaying accommodation; some cheap TENS units do not have modulating modes.

- A patient who isn’t tolerating TENS very well MAY do better with modulation mode.

- Pt. education is an IMPORTANT ISSUE with home use.

**Home use of TENS:**
The PT determines the appropriate parameters in the clinic (rate/frequency, pulse width and type of modulation). In general, the patient should not have to adjust these parameters at home but should know what the settings should be. The patient is instructed about how to:

- Apply the electrodes. Give the patient a body chart that shows where to apply the electrodes.
- Proper care for the electrodes
- Proper application procedures for the electrodes (alcohol prep, etc)
- How to control the intensity of the current
- A description of the appropriate treatment time and how often the treatment can be repeated

A list of contraindications & precautions should be given and explained.

**Reimbursement**
Insurance companies MAY reimburse for a portion of a lease or purchase of a TENS unit, usually categorized as durable medical equipment; MD prescription is typically required. . Some companies will reimburse for the purchase of a TENS unit if:

- The pain is intractable
- The pain is anticipated for a prolonged period of time
- TENS has been effective during a clinical or home trial

If a patient needs a TENS unit but the insurance will not cover, try to have info on a company that sells a basic unit for less than $100.
Regarding coverage for purchase of a TENS unit by Medicare and selling TENS directly to Medicare patients without a DME license. (From PT Manager Blog: www.ptmanager.com/PTManagerBlog)

**QUESTION:** My understanding is that Medicare commonly denies reimbursement for TENS units. Does that mean it would be legal for our clients purchase a unit from us, even though we do not have a DME license?

**ANSWER:** If you are a contracted provider with Medicare, you cannot solicit payment for any service or equipment that could possibly be paid for by Medicare unless a specific regulation is in place saying that that equipment is not a covered item or service. Medicare considers that to be Fraud. They take that very seriously. TENS still may be a covered item for certain diagnoses. To solve the problem, it is often recommended that you get a specific denial of service in writing, in this case a denial for TENS and then make sure to fill out an ABN.

The other issue is whether or not you then are considered a DME dealer or not and that is a gray area when it comes to providing equipment that is denied or not a covered service. I just think that you are running a high risk of problem to sell TENS units to Medicare patients even if they have been denied service.

Please don't mix up this with that I agree with this - I don't, but the regulations are there and I just feel that with all the increased scrutiny these days that it is not worth the risk. You may want to get a clarification from CMS on this to protect yourself

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**FOLLOW-UP QUESTION:** I am interested in what you said here, therefore do not look at this as criticism towards your response. My question is, if the patient wants to pay for a TENS out of their own pocket, why would CMS care as long as we know it would be denied in the first place? I am asking, because we have had conversations about selling TENS to patients also. One option is to have the patient buy the TENS themselves which would eliminate what we are talking about, but I am curious non-the-less.

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**ANSWER:** First of all you have to be sure to read the national coverage determination on TENS because it is not a blanket denial for all diagnoses. Medicare has recently opted to deny payment for TENS when used for chronic back pain but that is a limited denial for a specific diagnosis. It is my understanding that TENS may be covered for other selected diagnoses. Because of that, your plan to sell TENS units to Medicare clients runs a very slippery slope of being reviewed for fraud unless you can prove that they have a diagnosis which falls under their denials. It would probably be a better course to give those selected patients the information on where and how to get one on their own. Tech savvy seniors can get them online for reasonable prices - just have to direct them to a quality unit and online store.

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