Pain Management in the Canine Patient

LAURIE EDGE-HUGHES,
BSCPT, MANIMST(ANIMAL PHYSIO), CAFCI, CCRT

PART 4:
Acute Pain & Biomedical Approaches from a Rehab Perspective

LAURIE EDGE-HUGHES,
BSCPT, MANIMST(ANIMAL PHYSIO), CAFCI, CCRT
Acute Pain & Biomedical Approaches

When Pain is good:
1. Protects the area after an injury
   • Can make you limp after an ankle sprain
   • Can give you muscle spasm & muscle weakness after a muscle or joint injury
2. Warns the body of potential or actual damage
   • Tells your brain to take action (eg. Remove your hand from the hot stove!)

Acute Pain & Biomedical Approaches

What can REHAB offer for acute pain?
○ Pain from INFLAMMATION
○ NEUROPATHIC PAIN

Acute Pain Goals:
- Reduce pain
- Decrease inflammation
- Maintain function
Acute Pain & Biomedical Approaches

REHAB Treatment Options
- Therapeutic Physical Modalities
- Manual Therapies

Therapeutic Physical Modalities

Cryotherapy
- Works via conduction, conversion, convection
- Applied superficially but can have significant physiological effects, systemic & local.
Therapeutic Physical Modalities

Cryotherapy

- Cold affects the body by:
  - Decreasing the conduction velocity of primary afferent fibres &
  - Increasing pain threshold and pain tolerance
  - Vasoconstriction of blood vessels
  - Decrease tissue metabolism
  - Reduce muscle tone & spasticity
  - Gate-control: May act as a counter-irritant

Therapeutic Physical Modalities

Cryotherapy

- Studies show significantly lower pain scores in cold compression groups than in control groups including epidural analgesia, Robert Jones bandage, narcotic administration, and crushed ice.
  - Decrease in swelling + reduced blood loss
  - No difference in ROM of the Sx knee

Therapeutic Physical Modalities

Cryotherapy

- Use of cold compression therapy resulted in:
  - Lower values for the VAS and Glasgow pain scale and lower pain threshold scores
  - Lower lameness scores
  - Less swelling
  - Increased range of motion 24 hours after surgery.
  - At 14 days after surgery, there were no significant differences between Rx & control groups


Therapeutic Physical Modalities

Therapeutic Ultrasound

- A recent literature review found that there is currently no high quality evidence available to suggest that therapeutic ultrasound is effective for musculoskeletal conditions of the lower limb
- An older review stated ‘there seems to be little evidence to support the use of ultrasound therapy in the treatment of musculoskeletal disorders’

Shanks et al 2010; Van der Windt et al 1999
Therapeutic Physical Modalities

Therapeutic Ultrasound
- Cochrane Review: The results of 4 placebo-controlled trials do not support the use of ultrasound in the treatment of ankle sprains

In Conclusion.... Maybe don't bother with it!!

Van Der Windt et al 2002

Low Level Laser Therapy
- Uses:
  - Aid in tissue repair
  - Relieve pain
  - Stimulate acupuncture points

Woodruff et al 2004; Enwemeka et al 2004; Siendentopf et al 2002
Therapeutic Physical Modalities

Low Level Laser Therapy

- General Effects
  - Anti-inflammatory mechanisms (which can be similar to pharmacological agents such as celecoxib, meloxicam, diclofenac and dexamethasone)
  - The ability to reduce oxidative stress
  - Improved angiogenesis
  - Augmentation of collagen synthesis in skeletal fatigues
  - Inhibition of transmission at the neuromuscular junction

Bjordal et al 2006; Chow et al 2009

Therapeutic Physical Modalities

Low Level Laser Therapy

- DOSAGES
  - For Acute or Chronic neck pain, the optimum dose per point for an 820-830nm laser was 5.9 Joules with an irradiation time of 39.8 seconds and using a 904nm (super-pulsed) laser, it was 2.2 Joules delivered with an irradiation time of 238 seconds.
  - Positive effects were immediate and could be maintained for up to 3 months!

Chow et al 2009
Therapeutic Physical Modalities

Low Level Laser Therapy

- **DOSAGES**
  - Use LLLT at high doses (7.5 J/cm²) at the target tissue in the first 72 hours (to reduce inflammation)
  - Followed by the lower doses (2 J/cm²) at target tissues in subsequent days (to promote tissue repair) was most advisable.

  (don’t forget depth of penetration!)

Bjordal et al 2006

Pulsed Electromagnetic Field Therapy

- Reduction in pain and narcotic use with PEMF following breast reduction and breast augmentation surgeries
  - Ivivi technologies: 20 min Rx every 4 hours for first 3 days, then 2x/day thereafter

And that’s all I could find for PEMF and ACUTE pain!

Rohde et al 2010; Heden et al 2008

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Therapeutic Physical Modalities

Transcutaneous Electrical Nerve Stimulation

○ TENS is a modality utilized for pain relief.

○ Main mechanisms by which electro-stimulation produces pain relief:
  - Segmental inhibition through pain-gating mechanisms
  - Descending inhibitory mechanisms.

Baxter & McDonough 2007; Sluka & Walsh 2009

Therapeutic Physical Modalities

Transcutaneous Electrical Nerve Stimulation

○ Different frequencies of TENS produce analgesia through action on different neurotransmitters and receptors.
  - (Animal Models)

Baxter & McDonough 2007; Sluka & Walsh 2009
Therapeutic Physical Modalities

Transcutaneous Electrical Nerve Stimulation

- High frequency / conventional TENS (>60Hz):
  - Selective stimulation of larger diameter fibres in peripheral nerves
    - Helps to ‘block’ nociceptive activity in smaller afferents at segmental levels.
  - Increases the concentration of β endorphins in the bloodstream and cerebrospinal fluid

Baxter & McDonough 2007; Sluka & Walsh 2009

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Therapeutic Physical Modalities

Transcutaneous Electrical Nerve Stimulation

- Increases methionin-enkephalin in the cerebrospinal fluid, in human subjects.
- Reduces the release of the excitatory neurotransmitters glutamate and substance P in the spinal cord dorsal horn in animals with inflammation.

Baxter & McDonough 2007; Sluka & Walsh 2009
Therapeutic Physical Modalities

Transcutaneous Electrical Nerve Stimulation

- Low frequency TENS (<10Hz):
  - Stimulates a release of endogenous opiates
  - Is often referred to as acupuncture-like TENS because its mechanism of pain relief is similar to acupuncture.

- Primarily affects the relevant spinal segmental level, where opioid, GABA, serotonin, and muscarinic receptors are activated
  - (Which reduces dorsal horn neuron activity, nociception, and the consequent pain)

- Peripheral opioid receptors are also responsible for low-frequency (but not high-frequency) TENS analgesia.

Baxter & McDonough 2007; Sluka & Walsh 2009

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Therapeutic Physical Modalities

Microcurrent
- Aka: MES, MET, MENS, MCT, or CES
  - Electrical current at very low levels – often at below perceivable levels
    - Current less than 1 mA / 1000µA

Belanger 2004

Therapeutic Physical Modalities

Microcurrent
- Has been used successfully to treat many kinds of musculoskeletal pain.
- Transcranial electrical stimulation (CES) – delivered via earclips
  - Aids in depression, anxiety, insomnia, fibromyalgia, addiction, & cognitive dysfunction (lack of mental clarity subsequent to alcoholism, post-traumatic amnesia).
Therapeutic Physical Modalities

Microcurrent

- In the literature:
  - Reduction in DOMS (applied immediately post-Ex)
    - Curtis et al 2010
  - MET 0.5Hz x 1000muA x 20 mins/d x 7 days = better than TENS & helps with bruxism pain
    - Rajpurohit et al 2010

Therapeutic Physical Modalities

Microcurrent

- In the literature:
  - Use of Microcurrent following THR reduces the amount of fentanyl required post-operatively & improved wound healing compared to controls. (Sarhan & Doghem 2009)
  - Use of Microcurrent as part of a treatment (MET & stretching) for infant torticollis yielded better results and less crying than traditional therapies (US & Stretching) (Kim et al 2009)
Therapeutic Physical Modalities

Microcurrent

○ In the literature: (Rexing et al 2010)
  • Cold compress, MET with bandage, or cold compress with bandage = ALL were effective in reducing swelling 72 hours post CCLR in dogs vs bandage alone.
  • MET – Alpha Stim 600μA used a) crossing the joint in a large X, crossing in a small X and crossing both rear limbs. 0.5Hz (50% duty cycle, bipolar asymmetrical rectangular wave).
  • Using 2 probes (2 pairs with small X, 3 pairs with large X, and 3 pairs) 30 – 45 sec per pair with a total time of 5 – 7 minutes.

○ Therapeutic Physical Modalities

Microcurrent

○ In the literature:
  • Cranial Electrical Stimulation (CES = Microcurrent delivered via earclips to affect the brain) resulted in significant decrease in pain intensity in pts with SCI.
  • 100μA - 500μA x 1 hr/day x 21 days (Alpha-Stim) (Tan et al 2006)
  • CES was as effective as relaxation training (and both were better than control) for patients with anxiety. (Gibson et al 1987) - Alpha-Stim
Therapeutic Physical Modalities

- APPLICATION – *(TENS, MET, LASER)*
  - Application of modalities or electrode placement is a mix of art and science. Knowledge of the neuromuscular anatomy is helpful.
    - Incorporate acupuncture points
    - Localized areas of pain
    - Over a nerve
    - Over a nerve root (that supplies a dermatome / myotome in the painful area)

### Therapeutic Physical Modalities

<table>
<thead>
<tr>
<th>Canine Nerves, Nerve Roots, and Muscle Innervation</th>
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<tbody>
<tr>
<td><strong>Nerves</strong></td>
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<tr>
<td>Radial Nerve</td>
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<td>Median Nerve</td>
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<tr>
<td>Ulnar Nerve</td>
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<tr>
<td>Musculocutaneous Nerve</td>
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<td>Axillary Nerve</td>
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<td>Subscapular Nerve</td>
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<td>Femoral Nerve</td>
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<td>Sciatic Nerve</td>
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<td>Obturator Nerve</td>
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<tr>
<td>Anterior Gluteal Nerve</td>
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<tr>
<td>Posterior Gluteal Nerve</td>
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</tbody>
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Therapeutic Physical Modalities

In Summary:
- Therapists can use a variety of modalities to directly treat ACUTE pain
  - Cold
  - Laser
  - PEMF
  - TENS
  - Microcurrent
Manual Therapies

Traction & the Case of the Acutely Painful Disc

NR entrapment & NR inflammation

More pain & NR inflammation

Excitatory reflexive response of NR

Narrowing of NR foramina

Traction:
• reducing inflammation
• improving circulation
• reducing swelling

Traction: 2005 J

Jam 2005

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Manual Therapies

**Traction**
- Human pts with radiculopathy lasting >12 weeks have less favourable results with traction.
- Early intervention is more successful.
- Exposure of disc material to the vascular environment of the epidural space contributes to resorption and regression.
- Large extruded discs have more exposure and tend to regress more rapidly.

Constantoyannis et al 2002; Maher 2004; Ozturk et al 2005

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Manual Therapies

**Traction**
- Lumbar traction is most likely to be beneficial in patients with acute radicular pain of less than 6 weeks duration and concomitant neurological deficit.

Krause et al 2000

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Manual Therapies

Traction
- Cervical traction has been shown to have a positive impact (in combination with electrotherapy) in patients with radiculopathy.
- It is also plausible that the research conducted into manual therapy (mobs / manips) could well apply to traction therapy as well.
  - Inhibition of low threshold mechanoreceptors (group I & II) and high threshold nociceptors (group III & IV).
  - Reduction of intra-articular pressure
  - Reduction of peripheral afferent discharge

Manual Therapies

SUMMARY
- Acute Pain may be addressed in REHAB by:
  - Therapeutic Agents:
    - Cryotherapy
    - Laser,
    - TENS
    - Microcurrent
  - Manual Therapies
    - Traction
    - Mobilizations (grade 1)
      - see chronic pain section for more info

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