

**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

Markert SE. The use of cryotherapy after a total knee replacement: a literature review. Orthop Nurs. 30 (1): 29 – 36, 2011

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

Drygas, McClure, Goring et al. Effect of cold compression therapy on postoperative pain, swelling, range of motion, and lameness after tibial plateau levelling osteotomy in dogs. JAVMA 38 (10): 1284 – 1291, 2011.

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

Therapeutic Physical Modalities



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

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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!)



Bjordan et al 2006

Therapeutic Physical Modalities



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

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

Therapeutic Physical Modalities



Transcutaneous Electrical Nerve Stimulation

- High frequency / conventional TENS (>60Hz):
 - ✦ 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.



Baxter & McDonough 2007; Sluka & Walsh 2009

Therapeutic Physical Modalities



Transcutaneous Electrical Nerve Stimulation

- Low frequency TENS (<10Hz):
 - ✦ 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

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 / 1000 μ A



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).



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Therapeutic Physical Modalities

Microcurrent

○ In the literature:

- ✦ Reduction in DOMS (applied immediately post-Ex)
 - Curtis et al 2010
- ✦ MET 0.5Hz x 1000µA 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)

For a little fun,
click here to
perform
virtual
hip
surgery



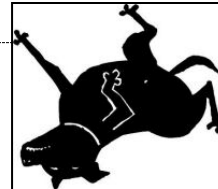
Therapeutic Physical Modalities



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 600uA 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.
 - 100uA - 500uA 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

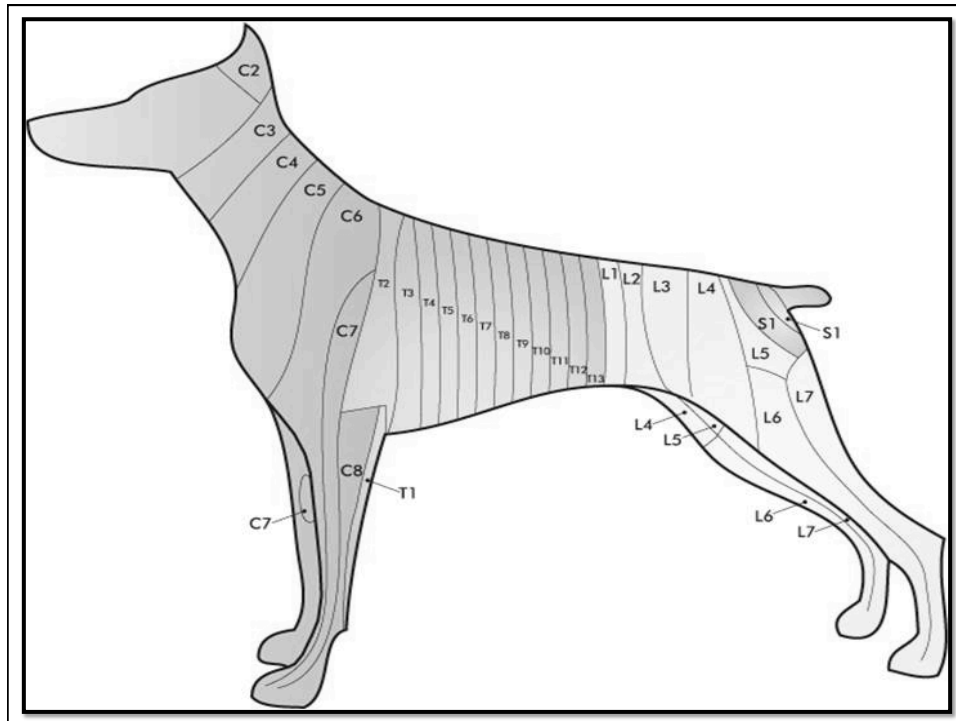
Therapeutic Physical Modalities

- 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

Canine Nerves, Nerve Roots, and Muscle Innervation		
Nerves	Root	Muscles
Radial Nerve	C7 – T2	All extensor muscles of the elbow & carpus & digits, supinator, brachioradialis, APL, EPL
Median Nerve	C8 – T2	Pron. Teres, Pron Quad., FCR, SDF, Radial head of DDF
Ulnar Nerve	C8 – T2	FCU, Ulnar & Humeral heads of DDF, Lumbricals, Interossei & elbow jt
Musculocutaneous Nerve	C7 (C8)	Coracobrachialis, biceps, brachialis
Axillary Nerve	C7, (C6 & C8)	Teres major, teres minor, deltoid (and subscapularis)
Subscapular Nerve	C6 – C7	Subscapularis
Suprascapular Nerve	C6, (C7)	Supraspinatus & infraspinatus
Pectoral Nerve	C7, C8	Superficial & deep pectorals
Thoracodorsal Nerve	C8, (C7, T1)	Latissimus dorsi
Femoral Nerve	L4 – L6, (L3)	All of the Quadriceps complex, iliopsoas, Sartorius
Sciatic Nerve	L6, L7, (S1, S2)	Hamstrings, quadratus femoris, gemelli, obturator internus, gastrocs, popliteus, tibialis posterior, tibialis anterior, digital flexotrs and extensors, Fibularis brevis, EHL, muscles of the foot
Tibial		
Peroneal		
Supf & Deep		
Obturator Nerve	L5, L6	Obturator externus, pectineus, adductor, gracilis
Anterior Gluteal Nerve	L7, S1	Glutei, TFL, capsularis
Posterior Gluteal Nerve	S1 – S3	Biceps femoris, Middle & Superficial glutes

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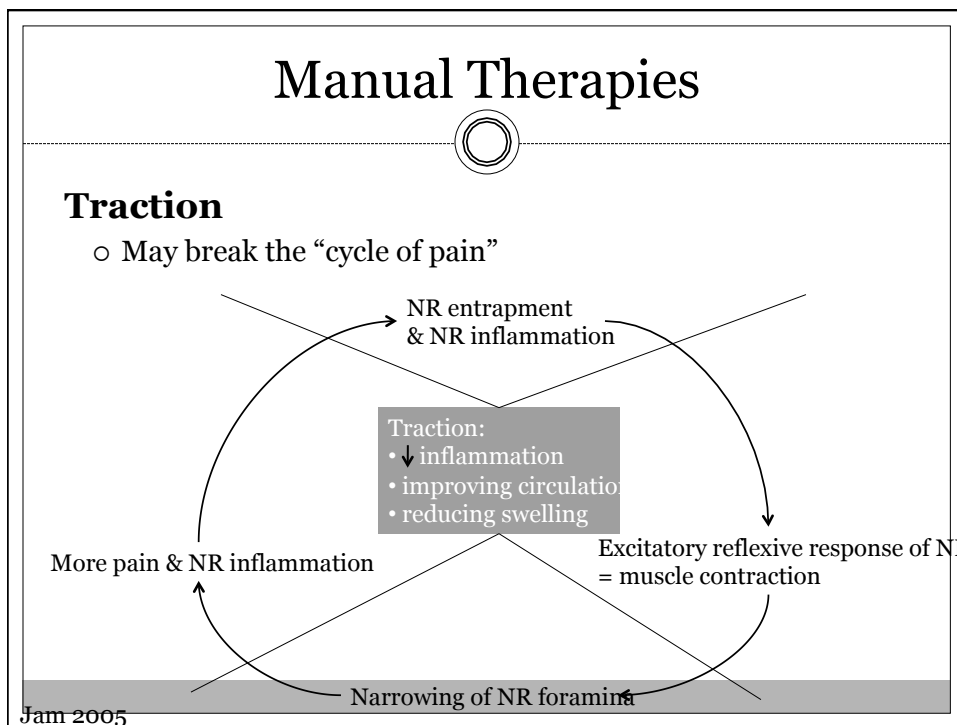
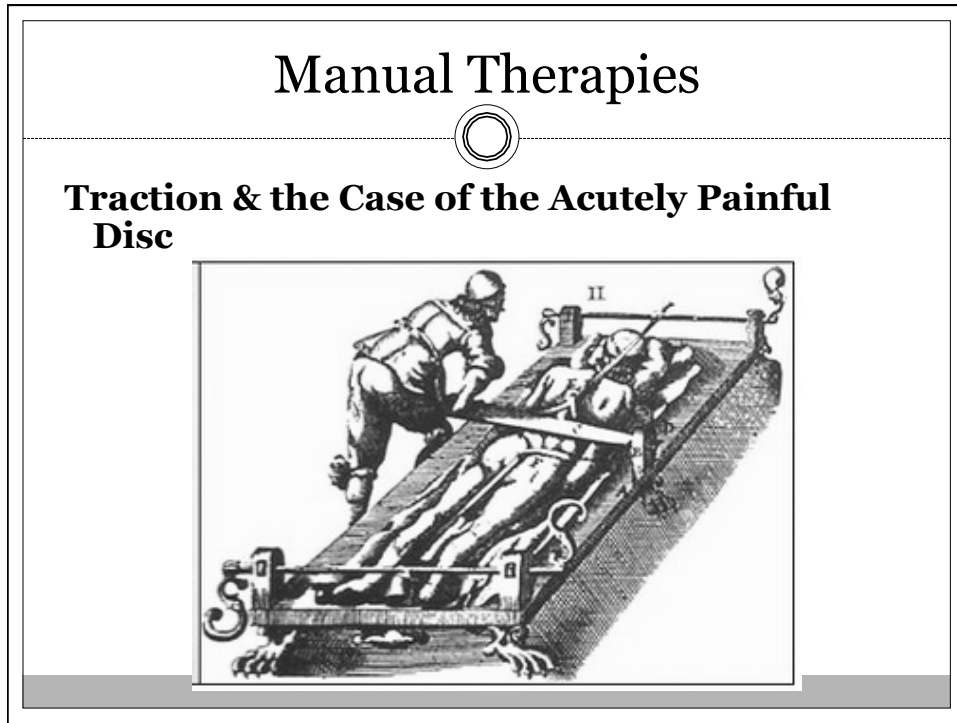


Therapeutic Physical Modalities

In Summary:

- Therapists can use a variety of modalities to directly treat ACUTE pain
 - ✦ Cold
 - ✦ Laser
 - ✦ PEMF
 - ✦ TENS
 - ✦ Microcurrent





Manual Therapies



Traction

- 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

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

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

Jam 2005; Zusman 1986

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

NOTE: Other therapies such as MASSAGE & ACUPUNCTURE may have a role here as well.