PAIN MANAGEMENT in the CANINE PATIENT

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Part 6

Therapeutic Modalities & Chronic Pain

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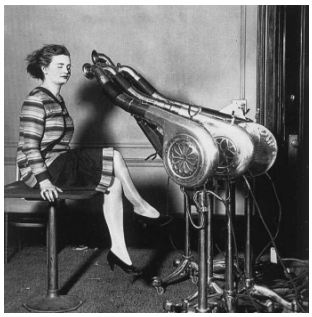
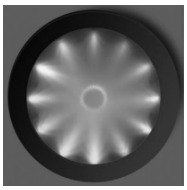
Therapeutic Physical Modalities

Thermal Therapy - HEAT

Conduction
e.g. Hot water bottle



Convection
e.g. Hair dryer or water immersion



Conversion
e.g. Sound waves, light energy

Therapeutic Physical Modalities

Heat decreases pain by:

- Pain gate control: blocking the stimulus from peripheral nociceptors
- Removal of chemical irritants from nociceptors (reducing pain input to the CNS)

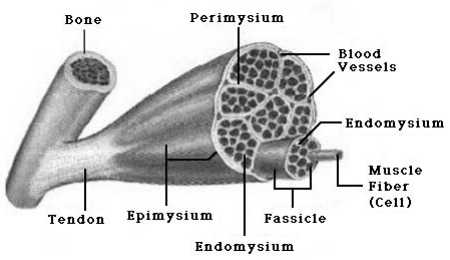
Therapeutic Physical Modalities

Heat reduces muscle spasm by:

- Alters the firing of muscle spindles and golgi tendon organs which results in reduced muscle tone

Heat aids in soft tissue elasticity by:

- Decreasing tissue viscosity

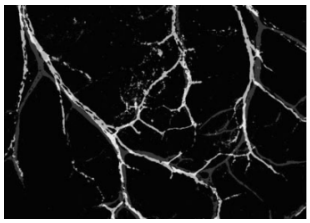


Therapeutic Physical Modalities

Heat affects nerve conduction by:

- 1. Increasing sensory and motor nerve conduction velocity
- 2. Reducing nerve and motor action potential amplitude

- Thus 'normalizing' nerve conduction *in nerve compression scenarios*



Therapeutic Physical Modalities

Heat - Clinically

- Joint stiffness can be reduced with heating
- A thermal therapy (paraffin wax bath) with exercises yields short term benefits for patients with arthritic hands

Therapeutic Physical Modalities

Heat - Clinically

- Superficial heat can provide short-term reductions in pain in cases of acute or subacute low back pain
- Studies have also shown that the application of a hot pack at a proximal location (e.g. the lumbar spine) can impact blood flow in distal parts of the body (e.g. the lower extremities)

Therapeutic Physical Modalities

CRYOTHERAPY

- Cold - Clinically:
  - Ice packs may provide benefits in terms of swelling and range of movement in osteoarthritis
- But…
  - Ice appears to be ineffective in terms of osteoarthritic pain

Brosseau et al 2003

Therapeutic Physical Modalities

IMPLICATION:

Hot & Cold

- In Chronic Pain States – **HEAT** may help (locally or centrally)
- In Chronic Pain States – **COLD** is not likely to help with pain, unless there is an acute on chronic flare up (where inflammation is involved)

Therapeutic Physical Modalities

ULTRASOUND and **Osteoarthritis** REVIEWS

- U/S could be efficacious for decreasing pain and may improve physical function in patients with knee OA
- U/S may be slightly beneficial for patients with osteoarthritis of the knee (function & pain)

Loyola-Sanchez et al 2010; Rutjes et al 2010; Srbely 2008

Therapeutic Physical Modalities

ULTRASOUND dosages for **Osteoarthritis**

- (Ozgonenel et al 2009)
  - 1 MHz frequency or 1 watt/cm2 power continuous ultrasound for 5 min
- (Tascioglu et al 2010)
  - CW U/S x 1Mhz x 2W/cm2 x 5 min/session x 5 days/week x 2 weeks
  - Pulsed US x 1MHz x 2W/cm2 x 25% x 5 min/session x 5 days/week x 2 weeks

Therapeutic Physical Modalities

ULTRASOUND dosages for **Osteoarthritis**

- (Huang & Yang et al 2005; Huang & Lin et al 2005)
- US improves strengthening benefits when combined with exercise in OA knees

- 2.5W/cm2 x 25% Pulsed x 15 min x 24 sessions in 8 weeks
- Either CW x 1.5W/cm2 x CW or
- 2.5W/cm2 x Pulsed 25% x 15min x 24 reps for 8 weeks.
  (NOTE: Pulsed was superior)

Therapeutic Physical Modalities

ULTRASOUND dosages for **Osteoarthritis**

- ***Cartilage*** effects
  - Activation of chondrocytes to *increase collagen synthesis*
  - (Korstjens et al 2004 & 2008 (in vitro); Naito et al 2010 (rats))
  - 1.5MHz x 0.3W/cm2 x Pulsed x 20 min
  - Therapeutic ultrasound *enhances cartilage repair* in the early stage, and has the effect of *arresting further deteriorative damage* in the later stage of induced arthritis. (bone scan) – (Huang et al 1997)

Therapeutic Physical Modalities

IMPLICATION:
Ultrasound

- In Chronic Joints – Ultrasound may be of benefit

Therapeutic Physical Modalities

What does the **LASER** research validate?

PAIN RELIEF with LASER is due to the following:	
Anti-inflammatory mechanisms similar to pharmacological agents (celecoxib, meloxicam, diclofenac, & dexamethasone)	
Ability to reduce oxidative stress	Improved angiogenesis
Augmentation of collagen synthesis & skeletal repair	Inhibition of transmission at the neuromuscular junction (reduced nerve firing)

Bjordal et al 2006; Chow et al 2009

Therapeutic Physical Modalities

LASER Dosages for **PAIN**

- High quality reviews & meta-analyses! (Bjordal et al 2003)
- Low level laser therapy significantly <u>reduces pain</u> and <u>improves health status in chronic joint disorders</u>
  - Knee doses: **2.1 – 12 Joules** (total per session)
  - Lumbar spine doses: **16 – 60 Joules** (per session)
  - TMJ doses: **0.7 – 2.1 Joules** (per session)
  - Cervical spine: **10 – 60 Joules** (per session)

Therapeutic Physical Modalities

LASER - A couple of cool RCT studies regarding **PAIN**:

- Chow et al 2006
  - 830nm laser, 300mW, 10J/cm2 / pt (30 sec/pt as per this laser), x up to 50 points (depending upon number of tender points) x 14 session x 7 wks = PAIN RELIEF in chronic neck pain patients. Effects were immediate & lasting up to 3 months!
- Chow et al 2007
  - 830nm laser, 300mW, 8J/cm2 directly over the DRG in RATS = **reduced mitochondrial membrane potential** and **decreased the available ATP** for nerve function THUS **blocked fast axonal nerve flow**
  - Resulting in a laser-induced neural blockade & subsequent pain relief!

Therapeutic Physical Modalities

What does the **LASER** research validate?

JOINT ARTHROPATHIES	
Enhance biosynthesis of cartilage	Stimulation of microcirculation
Reduce inflammation by reducing PGE2 & COX2 (in the synovium & synovial fluid)	

Cho HJ et al 2004; Soriano F et al2006; Lin YS et al 2005; Bjordal et al 2003; Hegedus et al 2009;

Therapeutic Physical Modalities

LASER Dosages for **Osteoarthritis**

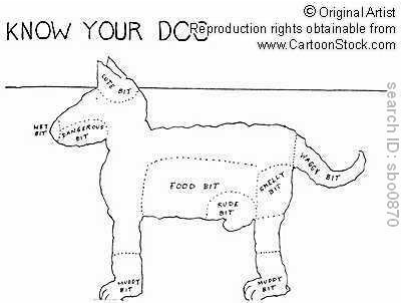
- High quality reviews & meta-analyses! (Bjordal et al 2007)
- For *Osteoarthritic knee pain*
  - 904nm super-pulsed lasers = 2 – 12 J / session (Total Joules)
  - 780 – 860nm lasers = 20 – 48 J / session (Total Joules)
  - When applied 2 – 8 points over the joint capsule

(And just in case, you're interested, this paper found that only TENS, electro acupuncture, and LLLT with optimal doses were clinically effective for short term pain relief for OA knees.)

Therapeutic Physical Modalities

- IMPLICATION:

  LASER
  - Joint Pain may be treated locally or centrally
  - Nerve Pain may be treated locally or centrally
  - Cancer Pain or General Pain may be treated centrally (over nerve roots)



Therapeutic Physical Modalities

Pulsed Electromagnetic Field Therapy

- PARAMETERS for **CARTILAGE / Osteoarthritis**
  - In the Literature: (Fini…2005; Zorzi…2007)
  - PEMF x 3 months x 6hr/day x 75Hz x 1.6mT = increased cartilage thickness (guinea pigs)
  - PEMF x 75Hz x 1.5 mT x 90 days x 6 hrs/day reduced NSAID use & improved knee Fx & pain scores (humans)

Therapeutic Physical Modalities

- IMPLICATION:

  Pulsed Electromagnetic Field Therapy

  - Maybe it will be beneficial as an adjunct to treat **Osteoarthritis**… But I wouldn't 'hang my hat on it'.

Therapeutic Physical Modalities

- Already discussed in ACUTE rehab, but still useful for CHRONIC cases:
  - **TENS**
    - For Acute Pain: 60 – 200 Hz and lower pulse widths produce a fast acting pain relief. The relief is short lasting however
    - For Chronic Pain: 2 – 4 Hz with a higher pulse width produces longer lasting pain relief.
  - **Microcurrent**
    - CES significantly improved mood in closed head injury pts better than controls. (Smith et al 1994)
      - 45 min daily, 4 days a week for 3 weeks

Therapeutic Physical Modalities

- Conclusion
  - Modalities can play an important role in pain relief
  - Use them strategically!