Creative Use Of Conditioned Pain Modulation
As A Novel Clinical Intervention

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AAOMPT 2015
Saturday, October 24, 2015
3:00 – 3:55 pm

Objectives
1. Participants will be introduced to the concept of Conditioned Pain Modulation (CPM) and the background literature surrounding its mechanism and use in the research setting.

2. Participants will learn about theoretical applications of CPM and why patient selection maybe needed.

3. Participants will learn about one clinician’s experience using CPM in the clinical setting.

Understanding Descending Inhibition

• Discovery of Descending Inhibition by Reynolds (1969)
• Referenced as DNIC in animal studies & early research
• Diffuse Noxious Inhibitory Controls
• Conditioned Pain Modulation (CPM) Human Studies
  • Tests integrity of central inhibitory pathways
  • Inhibition of pain in response to a noxious stimulus outside the site of injury
  • Can be reduced in patients with chronic pain

Descending Inhibition: Mechanism
Basic Explanation

• CPM works via the endogenous pain-inhibition system along descending pathways, inhibiting pain perception at the desired site by applying a painful stimulus to a remote or contralateral limb.
• Occurs in Spinal and Supraspinal Areas
• Involves: Opioids, Norepinephrine, & Serotonin

Research Projects On CPM
Marquette University

• Kathy Lemley PT, MS, PhD
• Stacy Stolzman MPT, PhD

Conditioned Pain Modulation Predicts Exercise-Induced Hypoglycemia in Healthy Adults

Kathy L. Lemley, Tara N. Hsu, and Mark K. Hoeger-Hinton
Department of Physical Therapy, Marquette University, Milwaukee, WI

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Lemley et al, 2015  Stolzman & Hoeger Bement, 2015
Pain Modulation

Free Resource

- [http://neuroscience.uth.tmc.edu/s2/chapter08.html](http://neuroscience.uth.tmc.edu/s2/chapter08.html)
- Open Access Online Text / Learning Module

My Interest In The Unharnessed Power Of CPM Begins To Grow...

The activation of bulbospinal controls by peripheral noxious inputs: Diffuse noxious inhibitory controls

Inhibitory effects do not depend on the subjective experience of pain during heterotopic noxious conditioning stimulation (HNCS): a contribution to the psychophysics of pain inhibition

Perspective on Diffuse Nociceptive Inhitory Controls as a Model of Endogenous Pain Modulation in Clinical Pain Syndromes

My Caseload

- > 50% Referrals For Spine Related Pain Conditions
- 25% Complex Orthopedic & Sports Conditions
- 20% Chronic Pain, CRPS
- 5% Misc

Could CPM be a viable intervention?

Just A Crazy Thought One Day: Use CPM As A New Treatment?

1. Hmm...If I induce pain in this remote area will the client report reduced pain at the targeted site or limb?
2. Hmm...If the research community already embraces CPM as an accepted test, I wonder how effective it would be for me in the clinic.
3. Hmm...Could all of this be that simple?
   - Ice water bucket + painful stimulus = Pain relief

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Could CPM be a viable intervention?

Translation of Research

Pillars of EBP

1. Applying what we know to the clinical setting
2. Use the research stimulus as the intervention
3. Low cost, Easy to apply, Immediate results & Patient "buy-In" anticipated

CPM: In the Clinical Setting 2012 - Present

What Do I Need?

1. Doctor's Order: No
2. Equipment: Yes
   - Bucket, Water, Ice
   - Thermometer: 60° F (Arbitrary)
   - Towels
3. Consent from client: Yes
4. Screening tools: Yes
   - Contraindications & Precautions: No Frostbite, No Allergies to Ice, No Fear of Cold, No Raynaud’s
5. Create a protocol: Yes
6. Patient selection: My next client (?)

Protocol

1. Fill the bucket & check temp
2. Determine the "asterisk sign"*
   - Targeted Task Or Outcome Measure
   - Test/No-Test Model
3. Submaximal remote extremity (start with contralateral side & limb) in the cold water
4. Send the water & wait until a painful response is elicited.
5. Record painful stimulus
6. Check the asterisk sign*
7. Document any changes that occur

Images from Geiser, Hoeger Bement

Images from Geiser, Hoeger Bement

Images from Geiser & Google

Geiser, Unpublished 2012-2015, In Progress
Clinical Knowledge Translation: 1st Attempt

Success ☑️

Client: Male, Left knee pain, MOI: Snow plow fell on knee
- CRPS after meniscus surgery, Does not tolerate clothing over his knee & parts of thigh, Limb discolorations (Red/Blue), Pain 5-5/10, Limb
- Worker’s Comp
- Asterisk sign* (Test, Re-Test) - Lunge onto step
- CPM: Contralateral hand (RUE) placed in plastic container of ice water until pain is felt.

Subjective Changes
1. Temporary but change: Perception of reduced pain reported (2pts)
2. Immediate response, Baseline pain returned when hand warmed

Objective Changes
1. Knee flexion observed improvement (5°)
2. Increased weight shift onto LLE, Increased pivots (onto affected side)

* Patient “Buy in” achieved
* Immediately wanted to try using CPM at Home

Another Session Of Supervised CPM
Same Client

More Success ☑️

Success with CPM at Home ☑️

• Client completes multiple reps of CPM in same supervised PT session

Subjective:
1. Pain 3-5/10
2. Pain diagram changes, Less area of the limb shaded in
3. Sense of “empowerment” over pain was verbalized
4. Less overall limb sensitization

Objective:
1. Gait speed: 1.09 m/sec → 1.3 m/sec
2. TUG improves: 7.9 sec → 7.27 sec
3. Knee flexion: 147°
4. Limb color improves, more flesh tones
5. Increased WB on LLE (CRPS Limb)

DC Status: 12 Sessions
(Last 5 Using CPM As Adjunct Treatment)

Nov 2011 (Eval) → Feb 2012 (CPM) → March 2012 (DC)
- Moved away/relocated, Still using CPM as self treatment)
- Reported quasi-regular use of CPM since February
- Modification to CPM: Also tries holding ice-pack in hand until stimulus was painful
RESULTS→ tolerated walking on grass on soccer field for 1st time in a year
- Also issued TENS, Attempted supervised trials with Laterality Training & Mirror Therapy in the clinic, however Work Comp not paying for equipment so DC’d

Success Story #1: DC Data

Subjective:
1. Baseline Pain 1-4/10 for entire month of March (only 3-4 breakout pain episodes)
2. Sleeping better (5 hrs)
- Acu-Mod TENS before test
3. Pain drawing improves
4. Rare – No sensitization at times
5. More community integration
6. 1 episode limb discoloration

Objective:
1. New hair growth on limb
2. Terminal knee ext (vs. flexed posture)
3. Flexion 147° maintained
4. Rare signs of limp
5. Reciprocal steps
6. Carrying 10# sometimes 20#
7. Kneeling & Squatting
8. Different fabrics on limb
9. Able to wear pants to work (1st time in a year)
10. Tolerates different shoes

CPM As A Regular Form Of PT Intervention

Cases 2, 3, 4…

1. Teenager, ACL reconstruction, struggling to get ROM, scar is painful: CPM works
2. Female, s/p TKR: CPM works
3. My own kids’ aches & pain after soccer (acute joint pain): CPM works
4. Multiple clients with CRPS wax in/out of my PT world: CPM works

- CPM produces different effects for each individual person, results seem to vary; some mild some very dramatic
- CRPS severity could be predictive factor. Robustness of inhibition is altered in these clients.


1. Did this client benefit from using CPM as adjunct treatment? Yes
2. Did this person’s quality of life improve? Yes
3. Did this client make measurable and functional changes from CPM? Yes
4. Did this person feel he had more "control" over his pain? Yes
5. Is it important that we empower our clients to succeed? Yes
6. Do I think he continued using CPM? Yes
7. Do I think he continued using his TENS? Yes
8. Did this single success story impact me as a clinician? Yes
9. Did I start using CPM on more clients? Yes
- How many more? Lots and lots and lots more clients.

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**My CPM Story...Retrospective Data**

Aim of today’s lecture: Share a few success stories.

Reflection:
1. Case B1 and a few other had lots of detailed documentation found; Other charts not so much
2. Time constraints for 45-50 min lecture at AADOMPT, Less 5 cases but more detail
3. Effects of CPM varies between clients but positive changes noted across different outcome measures and domains.
4. Charts started with HER (Epic) will probably be easier to access (no medical records dept. needed for archiving paper charts) and will offer best opportunity to find full detailed retrospective data
5. Any negative effects seen when CPM was used? YES, a few.
   - One client (severe CRPS, years of debilitating symptoms, multi-limb CRPS involvement immediately has positive outcome (quality of grip, increased distance tolerated, less dependency on assistive device post Rx); however later worries & has set back (Hmmm...)

**EVAL Images**

- Treadmill tolerated, 2.8 mph, Flexion continues to increase
- Psycho:
  - Majority of Resting Pain
  - Weak, + Limb Sensitization
  - Painful Stimuli
  - <6.65
  - Competitive
  - Any
- Bio:
  - Gait Speed: 1.36 m/sec
  - Long standing history of 2015, In Progress
  - Limb Desensitization 2015, In Progress
  - Biggest Fears: White paper, white clothing, white objects, metals/shiny object [Why? Unknown]

**Comments**

- She smiles when she tells me the story!

**Another Case**

**Female, 14 y/o, CRPS RUE, Dominant Arm, 9 Yr. History Of Pain**

Original Injury: Elbow fracture at age 5, Pinned, Casted, Hardware removed

Progressive pain, + sensory disturbance (Later Dx with CRPS)

**Biopsychosocial Issues**

- **Bio:**
  - Long standing history of elbow pain and abnormal sensations
  - Restricts RUE mobility and use; Mal-adaptive writing posture begins
  - Rightight signs (G2H) 2 is her loss of ROM even more important to restore?

- **Psycho:**
  - New school: HS (freshmen), new environment, new teachers, new friends
  - Majority of her friends and teachers were unfamiliar with CRPS
  - Disbelief from other healthcare professionals that her CRPS is real

- **Social**
  - Compete swimmer: Club team and High school team member (new coaches)
  - Avoids contact to right UE (purposeful or accidental)
  - Restricts all form of touch RUE (Do not hug family, shake hands, minimal contact at school dances)

- **Biggest Fears:**
  - White paper, white clothing, white objects, metals/shiny object [Why? Unknown]

**Important Subjective History**

**CPM + PT Interventions, 2012-2014**

**Novel Use of CPM**

- **Painful Stimuli**
  - Ice water bath submersion of Left Foot (LFE)
  - Most successful
  - Painful TENs application to LLE
  - Nice Alternative

- **CPM pain stimulus intensity**
  - Range 4/10

- **Initial pain relief achieved**
  - 25% to >50% (Avg)

**Traditional Physical Therapy**

- **Pain Education**
  - CRPS-education
  - Concepts of central sensitization
  - YouTube (Pain in 5 Minutes)
  - "explain Pain"

- **Limb Desensitization**
  - Graded exposure to touch, Metal & Clothing
  - Homework desensitization kit – Limited SS

- **FAB Training**
  - Acknowledge threats
  - Graded exposure to threats
  - Repeated exposure to threats
  - Traditional TENs use (GCT) for pain control
Positive Outcomes with CPM – RUE, 2012 - 2015

Visit 1  
Visit 15  
March 2013  
October 2013  
January 2014  
July 2012  
April 2013  
October 2013

Pain  
AROM  
Grip  
Pinch (3JC)  
WB Right  
Filament Testing

Bonus Outcome Measures, 2014

1. Saw drastic change in writing pattern
2. Wore long sleeve clothing
3. Touched white paper (short increments)
4. Hugged her mom more
5. Decreased 50 yd freestyle time by almost 1.5 sec & 100 yd almost 3 sec.

Client credited regular use of CPM as a factor in her improvement.

How/Why Did It Work?

1. Less overall pain intensity
2. Sense of "control" over pain
3. Easy to use, inexpensive
4. 20° change in RGM (Ext/Flex)
5. Less FABs

Other Biopsychosocial Issues

Classroom Set Up
1. Move her to right front corner of classroom
2. Put her desk next to a wall

Other Benefits

Graded Exposure to Clothing

- CPM helped control her baseline symptoms
  - Short Sleeves
  - Long Sleeves
  - White Clothing
  - Various Fabrics

Other Biopsychosocial Issues

Homework & Exams
1. Use colored paper whenever possible
2. Routines for exams

Ongoing Threats, 2014 (Improved, 2015)

- Physical Contact
  - Not regularly hugging parents
  - Boyfriend/Girlfriend relationships & school dances
  - Accidental touching of limb at swim meets/in crowds/with friends
  - Shaking hands with college swim coaches (Division III recruit)

- Ongoing Challenges to Paper (esp. white)
  - White paper in the community (newspaper, tickets, passes)
  - Accidental touching of limb at swim meets/in crowds/with friends
  - Decorations at school decorations (school, parties, convention hall)
  - What about next year? College environment (classroom, exams, people)

- Ongoing Challenges to Metal Found in Community
  - Silver ware in cafeteria, scissors, chemistry and art utensils, 2014
  - Currently this rarely bothers her, 2015
Something to Think About…

1. Remember when “manual therapy” was only talked about as an adjunct treatment to existing POCs?
   ➢ Back then early research showed us that subjects who received MT as an adjunct/augmented treatment did better than those who did not.
   ➢ Is CPM the next adjunct or augmented treatment?

2. What about standardizing CPM protocols in research?


1. Write up the case studies or compile a case series
   • Separate CPM ortho case(s) from CRPS/Chronic pain cases

2. Complete a full retrospective review
   • IRB: Exempt – But process completed
   • Barrier: Extraction from old paper charts & hybrid charts
   • Barrier: Sifting through HER (more medical history, co-morbidities & meds info available)
   • Barrier: I am a clinician by trade, not a researcher
   • Barrier: No internal assistance for the review. I will be tallying all this data myself.
   • I am an n=1. The process will be slow and tedious

3. Get the word out about CPM (Thanks AAOMPT 2015)

4. Start doing more pro-bono care?

How much data do I have? I HAVE NO IDEA! It will be interesting to see what is all there
   • Present caseload ➔ Shifting to chronic pain (~15 active CRPS pts)