Graded Motor Imagery: Application to Pelvic Pain

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Objectives:
- Describe Graded Motor Imagery and the evidence supporting it.
- Define the concept and challenge of conceptual change.
- Identify options for applying the science to patients with pelvic pain
- Identify which patients might benefit from Imagery and graded exposure
- Identify treatment targets and strategies for adapting the principles of GMI to pelvic pain

Part 1:
Graded Motor Imagery
- The History and Science of Graded Motor Imagery
  - Left/Right Recognition
  - Mirror Therapy
  - Imagery
- Progression in therapy
  - Moving from the lab to the clinic
  - Thoughts on application for pelvic pain (pre-evidence)

Conceptual Change
- Reconceptualizing pain
- Teaching pain science and GMI in the clinic

Part 2:
Assessment/Evaluation
Is Pelvic Pain different than any other pain?
- Imagine a sudden pain
  - What do you do?
  - Imagine it is in your pelvis – did anything change?
- What if it doesn’t go away?
  - Does persistent pelvic pain follow the same patterns as persistent back, shoulder, foot or knee pain?
  - Do the peripheral, spinal & central biological changes apply to the pelvic structures & their representation in the brain?
As pelvic pain persists is it less likely that tissues haven’t healed, & more likely that the brain is the proper target?

The problem of pelvic pain:

*Pain cannot easily be divided from the emotions surrounding it. Apprehension sharpens it. Hopelessness intensifies it. Loneliness protects it, by making hours seem like days. The worst pain is unexplained pain.*

-Hilary Mantel, IASP Insight, 2013

**Pelvic Pain is pain plus:**

- Cultural and religious challenges
- Gender driven challenges
- Sexual function
- Bowel and bladder function
- Privacy and personal space
- Practice patterns in health care

**A good evaluation includes an assessment of issues in the tissues vs. central pain states.**

- There is likely some of both
- Assess the contribution of tissue issue and central sensitization
- Check body awareness and sensitivity – a clue to their pain state
  - Does thinking about the part hurt?
  - Can that part be touched comfortably?
  - Can it be used normally?
  - Is the part perceived to be healthy or not healthy?
  - Pick a goal based on current functional status?
    - What can they tolerate now without flaring up?
    - What specific time or repetition will they use to advance?
    - How will you measure progress?

**Patient Interview**

*“Tell me why you are here & how it all started.”*

- Long term goals:
  - *“What does better mean to you?”*
  - *“How will you know when you are better?”*
- The hardest part? Be quiet & listen to the answers.

**De-Mystify the pelvis**

- Your handling skills and your confidence will give confidence to the patient.
- It is critical to not be the threat they are guarding against BUT... It is equally important to not be afraid of your patient, their pain or causing a little pain in treatment.
If we can “turn it on” we can “turn it off”

Their hurts CANNOT harm them

### Tissue Issues Vs Central Pain States:

<table>
<thead>
<tr>
<th>Tissue Issues</th>
<th>Central Pain States</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connective tissues stiff</td>
<td>Parasthesias</td>
</tr>
<tr>
<td><strong>Swelling</strong></td>
<td>Diffuse Pain</td>
</tr>
<tr>
<td><strong>Adverse neural tension</strong></td>
<td>Unpredictable pattern</td>
</tr>
<tr>
<td>Sore or stiff muscles</td>
<td>Flare up with little provocation</td>
</tr>
<tr>
<td><strong>Trigger points</strong></td>
<td>Allodynia</td>
</tr>
<tr>
<td>Weak, deconditioned</td>
<td>&gt;3-6 months of pain</td>
</tr>
<tr>
<td>Predictable healing</td>
<td>Stress/anxiety increase pain response</td>
</tr>
<tr>
<td>Predictable pattern</td>
<td>Plus symptoms under “Tissue Issues”</td>
</tr>
</tbody>
</table>

### Acute Vs. Persistent Pain

<table>
<thead>
<tr>
<th>Acute Pain</th>
<th>Persistent Pain</th>
</tr>
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<tbody>
<tr>
<td>Perceptual experience</td>
<td>Experiential state</td>
</tr>
<tr>
<td>Looking for the “bit and piece” that doesn’t work</td>
<td>Changes in sensory processing – CNS</td>
</tr>
<tr>
<td></td>
<td>No single cause</td>
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</tbody>
</table>

Treatment Target: Tissues

Treatment Target: Nervous system

### Tissue Dysfunction

- Treatment should respond predictably
- Unpredictable flares, trigger points that don’t respond, stress increasing pain
- Steady improvement not seen

**Consider nervous system component**

### History can suggest central sensitization


### The value of questionnaires in assessments

- Organizes information in a sensible format
- Saves time
- Use validated and reliable scales: Pain Catastrophizing Scale & Tampa Scale of Kinesiophobia
**Pain Catastrophizing Scale (PCS):** Magnification, Rumination, Hopelessness

**PCS Scoring**
- Patients who score above 30 on the PCS (75th percentile)
- 70% remained unemployed 1 year post-injury
- 70% describe themselves as totally disabled for occupationally-related activities
- >75th percentile (score of 30) are at high risk for developing chronicity
- 50th percentile or above: Raw score of 20 are considered at moderate risk for developing chronicity

**Tampa Scale of Kinesiophobia**
- Measures Fear-Avoidance
  - Somatization: Beliefs that pain indicates underlying serious bodily damage - more cognitive and emotional
  - Avoidance: Belief that activities which increase pain should be avoided - more behavioral
- Cut-off score: More at risk of persistent disability when raw score is around “42”
  - More at risk of persistent disability
  - With work-related LBP, neck, UE, LE: raw score around “42”

**The internal exam: Necessary in pelvic pain (with patient consent)**
- Proprioception
- PFM and Sphincters lack Golgi tendon organs (GTO)
- Gender specific differences
- Hypertonic vs. Hypotonic muscles
- *There is no other part of the body that we treat without assessing it first-increases the threat level in pelvic pain

**Laterality recognition: A clue to their perceptions**
- We can assess left/right judgements of the pelvic floor with internal work (proprioception)
- Can we further assess representations by looking at feet/trunk laterality judgments?
- *This may be indicative of changes in representation*

**Part 3:**
**Inputs, Outputs and Treatment Progression**

It’s Not All New
- Different context to evaluation & treatment techniques already in use
- Framework for graded exposure
  - Treatment reflecting GMI progression & perceived threat level
• How can GMI inspired principles be used to treat other types of chronic pain?

_Pain is a decision the brain makes_

PAIN IS A PROTECTOR/DEFENDER... NOT AN OFFENDER  (MOSELEY SOWH FALL CONFERENCE 2012)

- Perceived threat level
- Inputs to neuromatrix
- Accuracy of inputs affect outputs
- Precision level affects outputs

_Pain is an output...not an input:_ Neuromatrix Theory

**INPUTS TO NEUROMATRIX:**

**Proprioception:**
- Information from joints, muscles, tendons and skin about the positions and movements of the body parts; Position sense
- May be limited if patient has no experience with penetration
  - Tampons, Sexual contact/Intercourse, Self stimulation

**Interoception:**
- Information from nociceptors about the thermal, mechanical and chemical condition of the tissues; Sense of stimuli within the body
- Hormones
- Endocrine release

**Exteroception:**
- Taste, Touch, Smell, Vision, Hearing; Sense of stimuli outside the body
- May have no/limited sensory inputs of genitalia/vulva/vagina

**Cognitive:**
- Knowledge, memory, feelings, perceptions, belief, logic, attention, expectation, etc; Information you’re consciously & unconsciously aware of
- May be dominant source of inputs
- Patient may not be aware of thoughts already held
  - Abuse; Memories of unpleasant activity
  - Beliefs: Dirty, wrong, religious, not a good lover, something is wrong with me
  - Expectations: Sex is painful & always hurts, fear

_What can alter inputs to Neuromatrix?_

- Protective movement can modify proprioceptive inputs
- Pain response can modify cognitive inputs, thoughts, knowledge
- Inflammation can sensitize nociceptors; interoception

Inputs & the Body

Body Representation in Brain
- Can be activated without inputs from body
- Can be triggered by inputs; Inputs do not create representation

Sense of Self
- Dependent on inputs into CNS
  - Internal/external
- Disruption secondary to:
  - Altered inputs
  - Smudging
  - Decreased precision
  - Can change back to normal with improved consistency/accuracy of inputs

PATIENT EXAMPLE: Melissa: 34 y/o female; c/o dyspareunia

PMH: 1-2 years self treatment
- Vaginismus.com materials (dilators); counseling (individual & couples)
- Always pain with intercourse with all partners
- Conservative Jewish upbringing- against pre-marital sex, unspecified abuse history

Referred after miscarriage- tried intercourse 2 weeks after; was excruciatingly painful
- Husband uses Magnum size condoms; He’s too big & I’m too small
- Embarrassed- doesn’t enjoy sex
- “I am a failure to my husband b/c I can’t have sex & b/c I had a miscarriage”

Home Exercise Program

Progressed dilator program
- Medium with mirror during insertion & friction
- Using Medium; had pain/problems going to “Large”
- ID’d “Large” as threatening

Changed Inputs
- Replaced “Large” dilator terminology with “More Medium”
- Able to insert with no pain
- Changed Cognitive Inputs; added improved accuracy of visual (Exteroceptive) Inputs

OUTPUTS FROM NEUROMATRIX: Tissues are affected by outputs of brain/mind

Efferent Body Systems
- Immune response
  - Inflammation
  - May have altered histamine reaction in areas of body that body does not recognize as its own (Barnsley et al 2011)
- Endocrine response
Feeling/Perception

- This isn’t going to work
- I will never be able to do this
- I am broken
- Becomes Cognitive

Outputs become inputs: Why is this important?

- Need to consider all inputs
  - Inaccurate/imprecise inputs
  - Limited inputs
  - Inputs other than from musculoskeletal sources
- May be able to appropriately address all musculoskeletal impairments & still not change targeted outputs (pain)

Pain Goals

- We see patient outputs first
  - Provides insight to the processes the patient is running
  - Protective response outputs
- Patient’s goal is to change pain (output)
- Therapist’s goal is to have patient perform activity that doesn’t spark representation of pain response in the brain
- We are addressing the representation

Pain Change: Through progressive de-sensitization a patient can change

- Interpretation (Inputs)
- Representation (Outputs)
- What contributes to patient’s perceived threat?
  - Not limited to just musculoskeletal
  - In a sensitized nervous system the perception of threat must be evaluated. It is critical to avoid triggering this protective response in order to down-regulate the central pain mechanisms

Choose the right tools to affect cortical structures
- Patient education: understand pain
- Identify contributors to perceived threat level
  - Inputs/Perceptions
  - Outputs/Behaviors
- What can we manipulate in the environment to help change things? Moseley SOWH Fall Conference 2012
- Treatment progression including GMI inspired activities

Treatment Incorporating GMI Principals
- Motor Imagery
  - Imagined movement
  - Self generated representation (neurotag) in brain of a movement or posture without actually performing the movement or posture Graded Motor Imagery Handbook (Moseley et al)
  - Addressing potentially altered body image brought about by ongoing pain state
- Left/Right Discrimination: Implicit Motor Imagery
- Imagined Movements: Explicit Motor Imagery
- Mirror Movements

Progression Considerations:
- Start with most tolerable activity or other less threatening body region
- “It’s ok to be sore as long as you’re safe”
- Don’t increase more than 2/10 over initial pain state
- Example: if starting at 5/10; no more than 7/10; Work up to this for a week then progress to more threatening step; Attempt to avoid overstimulation of pain neurotag
- No right or wrong; individual experience

PATIENT EXAMPLE: Christie: “Something is wrong with me” 30 y/o female groin pain with sitting. Insidious onset 10 months ago after bike ride. Patient believes injury due to bike ride. Unable to watch others ride a bike or think about self riding bike without feeling nauseous & painful

PT Evaluation Findings:
- Negative neural tension testing
- Insignificant PT findings without correlation with patient c/o
- Negative imaging
- Some MD’s dx labral tear or want PRP (Platelet Rich Plasma Rx) without clinical findings
<table>
<thead>
<tr>
<th>GMI Step</th>
<th>Description</th>
<th>True GMI</th>
<th>GMI Influenced</th>
</tr>
</thead>
<tbody>
<tr>
<td>Watch</td>
<td>Others</td>
<td>• Pictures, video, magazines, live action</td>
<td>• Pictures, video, magazines; Live action;</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Anatomy instruction; Dilator/tampon instruction</td>
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| Left/Right Discrimination | Implicit Motor Imagery | • Less likely to activate pain neurotag (but still can)  
• Activation of Pre-Motor Cortex | • Recognise App (UE/LE/back/neck/knees) | • Recognise App: No genital/pelvic App; No clear L/R for this region  
• May not working in the same way  
• Consider use: Utilizing secondary non-threatening areas to the brain (increased sensitivity of pain neurotag)  
• Consider use of feet  
• Feet adjacent to genitalia in homunculus (Penfield)  
• Clarification of any potential homuncular smudging? |
|--------------------------|------------------------|-----------------------------------------------|---------------------------------|--------------------------------------------------------------------------------|
| Imagined Movement        | Explicit motor imagery | • More likely to activate the pain neurotag  
• Include as many of 5 senses as possible  
• Time taken to perform imagined & actual task is the same | • Think about another’s movement/activity  
• Think about self movement/activity | • Moving, touching, feeling  
• Dilators, tampons, etc  
• Can change context (similar to Recognise app- vanilla, context) |
| Mirror movement          | Looking in mirror to see reflection of limb: illusion you’re looking at hidden limb; Using mirror to trick brain  
• Those with greatest pain relief have ability to imagine moving affected area Graded Motor Imagery Handbook (Moseley/Butler)  
• Proper GMI progression  
• Need true accurate mirror | • Difficult with vagina/vulva  
• Using mirror to increase visual inputs to neuromatrix  
• Spatial neglect v. body part sided neglect  
• Enriching experience using mirror in varied contexts: Mood, Circumstances, Places  
• ID anatomy; observe object insertion; partner use; I feel swollen (are actually not) |

**PATIENT EXAMPLE:** Susanna 29 y/o dx dyspareunia

Previous pain free sex. Pain after frequent “yeast infections” & self rx, cyst removal. C/o itching, burning, pain with deep penetration. Initial inappropriate medical management in student health; sought counseling with partner. Nervous before sex, worried he thinks she’s not interested. Diagnosed with vulvodynia, + Q-tip test.
TREATMENT: Dilator Progression

- Started with XS, S, M in conjunction with manual rx (internal/external).
- Unable to insert large dilator
  - Patient would try but pain prevented full insertion
  - Words/thoughts- fear of ripping/tearing
- Used mirror with large insertion- pain free
- Changed Exteroception/ Cognitive Inputs with mirror
  - Changed Outputs

ADDITIONAL CONSIDERATIONS:

- Where to practice?
- Eyes open or closed?
- Body position?
- 1st or 3rd person thought?
- Frequency?
- Duration?
- Use meditation or breathing in conjunction?
- Complexity/intensity of session?
- Words PT uses to guide?
- Words patient thinks during process?
- Prior demo?
- Cueing- sounds, smells, etc?
- How much do I know about the changes?
in the brain I can achieve with imagery?

**PATIENT EXAMPLE:** Nancy: 62 y/o Female with Coccyx/Pelvic Pain

**PMH:** Fall on ice at inauguration 2009. History of left plantar fasciitis/calf pain. 2008 fracture left foot. Hx of sexual abuse, eating disorders. Husband BBK amputee Vietnam: “I’m worried he’s going to get better before I am” - (after his TKR)

**FUNCTION:**
- Sitting limited to 3 minutes: Will not sit to play with grandchild
- Will only lay down in car/cab
  - Pain worsens after neuropsychologist sessions; Challenge; increased threat; Face flushed

**TREATMENT:** Began Explain Pain Education 10/2011

Began Recognise: 5/2012-7/2013; 20 images/5 sec each
- Vanilla Feet:
  - Accuracy: Left (63%); Right (66%); Timing: Left 4.3s; Right 2.8s; Response: slower left recognition due to chronic left foot injury
- Context Feet:
  - Accuracy: Left (27%); Right (66%); Timing: Left 2.2s; Right 3.2s
- Feet v. Hands v. Pelvis

**What does this mean?**
- Feet images more threatening than hands
  - Foot injury?
  - Homunculus?
- Context more threatening than Vanilla
- Patient’s speed/accuracy scores better when self-perceived pain level & mood improved
- Some improvement in Fear Avoidance scores over time when Recognise & pain education utilized in treatment
- Regardless of prior pain education, improved perceived function with adherence to Recognise App
  - Decreased with lack of adherence

**Pre-Evidence & Questions for Future Research**

Pelvic Pain
- Possibly similar to CRPS: can we use the research?
- If it is longer than 3 months, there is likely central sensitization
  - We can reason that the tissues and cortical representation in the pelvis are no different and follow the same physiology as those of the hands, arms, feet, back, neck and face...
  - All of which have some robust research for Graded Imagery and Graded Exposure with
central sensitization
- Vulvar vestibulitis: histamine response
  - Does brain recognize this area as its own?
  - Don’t forget those old nerve root/spinal injuries...

Q-tip test: “Gold Standard” in medical research
Using mirror v. no mirror; Patient do on self (with or without mirror)

Other questions for future research?

**Contact Information:**

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Twitter: @CJ_PaglianoPT
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March 21–23, 2014
Speaker: Lori Mize, PT, DPT, WCS
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June 20–22, 2014
Speaker: Lori Mize, PT, DPT, WCS
Majum, PT, DCS-PMD
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July 11–13, 2014
Speaker: Lori Mize, PT, DPT, WCS
Barb Settles-Huge, PT
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October 10–12, 2014
Speaker: Carina Siracusa Majum, PT, DPT
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November 14–16, 2014
Speaker: Barb Settles-Huge, PT
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**Pelvic Physical Therapy 2**

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Speaker: MJ Straugh, PT, BC-BMD
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References:


Nijs J, et al., Thinking beyond muscles and joints: Therapists’ and patients’ attitudes and beliefs regarding chronic musculoskeletal pain are key to applying effective treatment, Manual Therapy (2012), http://dx.doi.org/10.1016/j.math.2012.11.001


Notes from Section on Women’s Health Annual Conference, Portland OR, October 2012


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