Merging Pain Science and Movement in a Biopsychosocial Treatment

Chris Joyce PT, DPT, SCS
Assistant Professor
Doctoral Student
Objectives For Today

• To understand the general processes of nociception, peripheral and central sensitization
• To be able to beneficially apply this understanding to comprehensible education for patients
• To merge pain neurophysiology, movement into a biopsychosocial treatment of a patient in pain
• To apply learned concepts to patient cases
Objectives 1 and 2

- To understand the general processes of nociception, peripheral and central sensitization
- To be able to beneficially apply this understanding to comprehensible education for patients
Your Body

Your Shoulder/Back/Knee
A TYPICAL PAIN NEUROTAG

1. PREMOTOR/ MOTOR CORTEX
   organize and prepare movements

2. CINGULATE CORTEX
   concentration, focusing

3. PREFRONTAL CORTEX
   problem solving, memory

4. AMYGDALA
   fear, fear conditioning, addiction

5. SENSORY CORTEX
   sensory discrimination

6. HYPOTHALAMUS/ THALAMUS
   stress responses, autonomic regulation, motivation

7. CEREBELLUM
   movement and cognition

8. HIPPOCAMPUS
   memory, spatial recognition, fear conditioning

9. SPINAL CORD
   gating from the periphery
If You Broke Your Toe, Would It Hurt?
If You Broke Your Toe, Would It Hurt?
Results:
Moderate evidence of relationship in cross-sectional studies, Moderate evidence of no relationship in prospective studies

Results (cont.):
All groups showed improvement in self-reported pain and disability scores; however, there were no significant differences between the groups.

Conclusion (cont.):
…however these outcomes were achieved without a concurrent change in strength.
Imaging and Pain

- 50% Rotator Cuff tears
- 47% SLAP tears

Navarro-Ledesma et. al *(Musculoskelet Sci Pract 2017)* - Ultrasonography of 97 patients with chronic shoulder pain
- No correlation between acromio-humeral distance and shoulder pain function and ROM

- 55% and 72% had SLAP tears
49 Distinct Findings
0 Findings consistent in all 10 reports
37% Findings appeared only once
Fleiss kappa statistics = .20 (poor overall agreement)
The Pain System becomes the problem

Descartes, 1644
Nociceptors

Pain

Neuromatrix (Brain)

Decreased ROM

Decreased Strength

Increase Swelling
**Sensitization**

- **Hyperalgesia** - Heightened sense of pain to noxious stimuli
- **Allodynia** - Pain resulting from normally painless stimuli

---

- **Pain Intensity**
- **Stimulus Intensity**

- Injury
- Normal pain response
Peripheral and Central Sensitization

https://www.youtube.com/watch?time_continue=287&v=YwDMmSwUOOU
Conclusion
For chronic MSK pain disorders, there is compelling evidence that an educational strategy addressing neurophysiology and neurobiology of pain can have a positive effect on pain, disability, catastrophization, and physical performance.
Objectives 3 and 4

- To merge pain neurophysiology, movement into a biopsychosocial treatment of a patient in pain
- To apply learned concepts to patient cases
Movement Based Interventions

- Task-Specific Training
- Graded Exposure
Task-Specific

[ CASE REPORT ]

Task-Specific Training for Adults With Chronic Knee Pain: A Case Series

BACKGROUND: Recent evidence suggests that traditional impairment-based rehabilitation approaches for patients with knee pain may not result in improved function or reduced disability.

Bove et. al 2017, JOSPT
Task Specific Training

1. Identify tasks that are commonly difficult or painful
   a. Patient-reported
   b. Evidence-informed
2. Prescribe task-specific interventions
   a. Utilize neuromotor learning principles
   b. Neuroplasticity?
Task Specific Training

• Example: Pain with ascending/descending stairs
  • Part Practice: Weight shifting, weight bearing, contralateral push-ing
  • Blocked Practice: Repeating the same part over and over again without interruption i.e. step ups on small step using only one leg, then switching
  • Random Order: Interspersing variability in practice i.e. switching legs, going up/down, changing foot position, changing weight bearing support or amount, change technique
  • Open Environment Practice: Real staircase, with people, with distractions, carrying things, talking on phone
  • Maximize Repetitions

Bove et. al 2017, JOSPT
# Table 3

**Baseline and Follow-up Scores on 3 Subscales of the KOOS**

<table>
<thead>
<tr>
<th></th>
<th>Patient ID</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A</td>
</tr>
<tr>
<td><strong>Pain subscale</strong></td>
<td></td>
</tr>
<tr>
<td>Baseline</td>
<td>11.1</td>
</tr>
<tr>
<td>Follow-up</td>
<td>38.9</td>
</tr>
<tr>
<td>Change</td>
<td>27.8</td>
</tr>
<tr>
<td><strong>Symptom subscale</strong></td>
<td></td>
</tr>
<tr>
<td>Baseline</td>
<td>35.7</td>
</tr>
<tr>
<td>Follow-up</td>
<td>42.9</td>
</tr>
<tr>
<td>Change</td>
<td>7.2</td>
</tr>
<tr>
<td><strong>ADL subscale</strong></td>
<td></td>
</tr>
<tr>
<td>Baseline</td>
<td>25.0</td>
</tr>
<tr>
<td>Follow-up</td>
<td>47.1</td>
</tr>
<tr>
<td>Change</td>
<td>22.1</td>
</tr>
</tbody>
</table>

*Abbreviations: ADL, activities of daily living; KOOS, Knee injury and Osteoarthritis Outcome Score.
*For each KOOS subscale, possible scores range from 0 to 100, with 0 representing extreme problems and 100 representing no problems.*
Your patient states when they raise their arm overhead they have anterior shoulder pain. They’ve been told that they have “impingement” and that their rotator cuff is fraying like a rope when it gets jammed in between the acromion and head of humerus. They’ve heard that impingement is a precursor to rotator cuff surgery, which they do not want, but they feel like they can’t lift their arm above their shoulder without having any pain. This pain has been going on for 2 months despite rest, ice, NSAIDs, and activity modification to avoid OH activities.
Task Specific Training

1. Identify tasks that are commonly difficult or painful
   a. Patient-reported
   b. Evidence-informed

2. Prescribe task-specific interventions
   a. Utilize neuromotor learning principles
   b. Neuroplasticity?
Task Specific Training

1. Identify tasks that are commonly difficult or painful—Shoulder Elevation
   a. Patient-reported
   b. Evidence-informed

2. Prescribe task-specific interventions
   a. Utilize neuromotor learning principles
   b. Neuroplasticity?
Task Specific Training

• Example: Shoulder Elevation
  • Part Practice: Isometrics, Modified ROM exercises, Mirror therapy
  • Blocked Practice: Repeating the same part over and over again without interruption
  • Random Order: CKC shoulder elevation, sidelying elevation, prone PROM, OKC into CKC elevation
  • Open Environment Practice: Reaching while on the phone, sitting and reaching, throwing a ball, waving,
  • Maximize Repetitions
Graded Exposure

Graded Exposure to Fear vs. Graded Exposure to Painful Movements

1. Identify the movement or activity that patient is fearful of
   - Fear of Daily Activities Questionnaire\textsuperscript{17} – VAS Scoring System
   - Fear Avoidance Belief Questionnaires\textsuperscript{18} – Likert Scale Questionnaire

2. Involve the movement or activity in your treatment

3. Reassess fear

4. Increase the intensity of the activity or movement
   - Can increase duration, load, volume or any other progressive variable
Physical Therapy Utilization of Graded Exposure for Patients With Low Back Pain
Appendix.
Fear of Daily Activities Questionnaire

People with low back pain have told us that they are fearful of performing certain activities because they believe these activities will cause additional low back pain or reinjure their back.

Examples of such activities are listed below. Using the provided scale, please rate each activity for the amount of fear it causes you, as it relates to your low back pain. Because not all activities are fearful for all people, we are also asking you to list two different activities that cause you fear and to rate the fear associated with those activities.

<table>
<thead>
<tr>
<th>Activity</th>
<th>Rating (0–100)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Sitting for longer than 1 hour</td>
<td>40</td>
</tr>
<tr>
<td>2. Standing for longer than 30 minutes</td>
<td>50</td>
</tr>
<tr>
<td>3. Walking for longer than 30 minutes</td>
<td>60</td>
</tr>
<tr>
<td>4. Lifting less than 20 pounds</td>
<td>20</td>
</tr>
<tr>
<td>5. Lifting 20 pounds or more</td>
<td>40</td>
</tr>
<tr>
<td>6. Carrying less than 20 pounds</td>
<td>20</td>
</tr>
<tr>
<td>7. Carrying 20 pounds or more</td>
<td>40</td>
</tr>
<tr>
<td>8. Twisting</td>
<td>10</td>
</tr>
<tr>
<td>9. Reaching to the floor</td>
<td>20</td>
</tr>
<tr>
<td>10. Performing back exercises</td>
<td>30</td>
</tr>
<tr>
<td>11. Folding laundry</td>
<td>60</td>
</tr>
<tr>
<td>12. Walking up incline</td>
<td>60</td>
</tr>
</tbody>
</table>

(No fear of activity) (Maximal fear of activity)
<table>
<thead>
<tr>
<th>TABLE 5</th>
<th>TREATMENT SUMMARY FOR INITIAL GRADED EXPOSURE TREATMENT SESSIONS FOR PATIENT 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Physical Therapy Session 1</td>
</tr>
<tr>
<td>Fearful activity 1: walking up steep hill</td>
<td></td>
</tr>
<tr>
<td>Preactivity fear level</td>
<td>60/100</td>
</tr>
<tr>
<td>Clinic activity</td>
<td>Treadmill walking, 3 min, 3.0% incline, 1.9 km/h</td>
</tr>
<tr>
<td>Postactivity fear level</td>
<td>10/100</td>
</tr>
<tr>
<td>Fear reduced?</td>
<td>Yes</td>
</tr>
<tr>
<td>Plan</td>
<td>Progress exposure time</td>
</tr>
<tr>
<td>Fearful activity 2: folding laundry</td>
<td></td>
</tr>
<tr>
<td>Preactivity fear level</td>
<td>60/100</td>
</tr>
<tr>
<td>Clinic activity</td>
<td>Floor-to-table lift, 4.5 kg, 10 times</td>
</tr>
<tr>
<td>Postactivity fear level</td>
<td>20/100</td>
</tr>
<tr>
<td>Fear reduced?</td>
<td>Yes</td>
</tr>
<tr>
<td>Plan</td>
<td>Increase repetition and include standing time</td>
</tr>
</tbody>
</table>
Initial Session:
- Identify most fearful activities (FDAQ)
- Patient reports level of activity he/she is willing to perform with increase in fear

Subsequent Sessions:
- Patient performs fearful activities (level of determined based on previous session)
- PT monitors session
- FDAQ reassessment

Does patient have less fear of activities?

- **YES**
  - + Reinforcement
  - Increase activity level \(\geq 10\%\) (duration, frequency, intensity)
  - Repeat Process

- **NO**
  - Reinforcement of Importance
  - No change in activity level (duration, frequency, intensity)
  - Repeat Process

George et. al 2009, *JOSPT*
References


6. Higdon L. Patient Hostility, the Working Alliance, and Treatment Outcome in a Work Hardening Center. Chicago, IL: The Herman M. Finch University of Health Sciences, The Chicago Medical School; 1997:120.


References


Pictures

- http://onlinealarmkur.com/assets/icons/online-alarm-clock.jpg
- http://www.marvin.com/images/home/heritageinnovation.png
- https://i.ytimg.com/vi/3QVAY5stO3U/maxresdefault.jpg