An Interdisciplinary Approach to the Treatment of Pediatric Chronic Pain

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Faculty Disclosure Information
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Objectives
• Epidemiology
• Probable mechanisms of overlapping clinical presentations
• Functional and structural changes in the nervous system

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**Slide 4**

Chronic Pain: The Role of Plasticity

- Injury, trauma, illness
- Acute pain → Delayed healing with neuroplasticity
- Normal Healing 3 mo.
- Abnormal sensory processing: allodynia, hyperalgesia, hyperpathia, dysesthesia, etc.
- Pain relief
- Chronic pain

**Slide 5**

Chronic Pain Characteristics

- Lasting > 3-6 months
- Persistent or recurrent
- Organ / system specific
- Pain is out of proportion to the original cause
- Interferes significantly with QoL

**Slide 6**

Epidemiology

- Studies have identified chronic pain as an important childhood & public health problem, costly, & disabling
- Affects ~ 5% of children and adolescents
- USA (2007-08): 18% of 6-17 yrs. have pain conditions
- School-based incidence in : 15 – 30%
- Prevalence for disabling pain 1 - 3% of general population
- May persist into adulthood

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Epidemiology of Chronic Pain in Children & adolescents: A Systematic Review
King et al, PAIN 2011

- Prevalence rates (1991-2009)
- Headaches (most common) 08 – 83%
- Abdominal pain 04 - 53%
- Musculoskeletal pain 04 - 40%
  - Back pain 14 - 24%
- Multiple pains 04 - 49%
- Other pains 05 - 88%
- Overall median prevalence rate 11 – 38%

Epidemiology of Chronic Pain in Children & adolescents: A Systematic Review
King et al, PAIN 2011

- Pain prevalence was higher in
  - Females and increased with age
  - Low socioeconomic status esp. headaches
- Risk factors for development/maintenance
  - Psychological, socio-demographic, cultural, parental factors, etc.
- Interpret the prevalence with caution

Epidemiology of Chronic Pain in Children & adolescents: A Systematic Review
King et al, PAIN 2011

Musculoskeletal Pain prevalence rate is 4 – 40%
Slide 10

Inpatient Characteristics of the Children with Chronic Pain

At discharge 14% of patient had CRPS

Coffelt et al., Pediatr 2013

Slide 11

Summary of Characteristics of children admitted with Chronic pain (n=3752)

Coffelt et al., Pediatr 2013

Slide 12

Summary of Characteristics of children admitted with Chronic pain (n=3752)

Coffelt et al., Pediatr 2013

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Health care utilization
Groenewald et al., 2014

- Retrospective web-based survey
- 10-17 yrs.; pain > 3 mo.; >1/wk., disabling
- MSK > multiple locations > FAP > HA
- Estimated mean costs per adolescent presenting to a multidisciplinary pain center were $8019 in 2013

Healthcare Expenditures in Pediatric Pain-related conditions in USA
Groenewald et al. Pain.2015

Syndromes: Symptom clustering
Fleming & Yarnitsky 2015

- Categorize according to most worrisome symptom e.g., CFS, FM, FAP, etc.
- Amplification of sensory input across many organ systems due to neuroplasticity
- Sensory/auditory/visual/olfactory, chemicals
- Emotional distress, cognitive impairment
- Somatic symptoms:, physical and mental exhaustibility, dizziness, insomnia, etc.
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Chronic Pain Disorders
Treatment Challenges

- Underlying peripheral and central mechanisms are not fully understood in individual patients

- Specific safe and efficient analgesic “cure” is not available
Slide 22

Pain-related physical disability

Cortical reorganization of sensory-motor cortex function

Pain sensory input

Immobilization

Muscle atrophy

Cognitive factor, FOP, anxiety, coping, etc.

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• Tonic muscle pain can inhibit the motor cortex at an early phase and followed by a reduction in excitability of both cortical and spinal motor neurons
• MEP and Ri-reflex inhibition

Slide 24

Prevention of cortical reorganization caused by immobilization

Roll et al., NeuroImage 2012

8 volunteers; hand splint with proprioceptive stimulation for 5 days to maintain movement perception and 8 untreated

Illustrates the value of OT and passive proprioceptive feedback
Exercise-based Interventions

- Regular exercise reverses sensory hypersensitivity in a rat neuropathic pain model: role of endogenous opioids.
  - Stagg et al., Anesthesiology 2011
- Fatiguing exercise attenuate pain-induced corticomotor excitability
- No studies have directly examined brain responses to pain before and after a standardized exercise protocol; BOLD

Fatiguing exercise attenuates pain-induced corticomotor excitability
- Hoeger B, Neurosci Lett 2009

Treatment with CBT increases activity of prefrontal cortex chronic pain adolescents & adults
- Jensen KB Pain 2012

PFC: Attenuation of vigilance and attention to pain
Decreased thalamic activity is implicated in pain pathology

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Changes in the neural correlates of implicit emotional face processing during 8-week sertraline treatment in MDD

Victor et al. (2013), 16, 2195

fMRI responses correlated with reduction in clinical severity of depression (HAMD)

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- Evoked mechanical or cold allodynia produced CNS activation similar to adult CRPS. Allodynia produced significant decreases in BOLD signals, suggesting activation of DIS
- Cold or brush activated the basal ganglia and parietal lobe that may explain movement disorders & neglect or inattention
- Results suggest significant changes in CNS circuitry in patients with CRPS

Slide 30

Restoring Health

Bio-physical

Psycho

Social

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References List


References List


References List

Thank you for your attention

Q & A

Cure sometimes, treat often, comfort always

Hippocrates

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An Interdisciplinary Approach to Pediatric Chronic Pain

Julie Shulman, PT, DPT, PCS
Boston Children’s Hospital – Mayo Family Pediatric Pain Rehabilitation Center
APTA Combined Sections Meeting
Anaheim, CA
February 19, 2016

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No conflicts of interest or disclosures

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What are we missing?

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Objectives

• Why is treating chronic pain so challenging?
• What can physical therapists do differently to improve outcomes?
• How can we prove it works?

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Pediatric chronic pain is:

- COSTLY: 19.5 Billion per year
- CONSEQUENTIAL
- COMPLEX
- COMMON 11-38% of youth

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What is pain?
• IASP 2012: "an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage"[^8]

How physical therapists view pain...

What it really looks like...[^9]
Slide 43

BioPsychoSocial Model of Pain

Biological:
- Structural
- Psychological:
- Cognitive appraisal
- Coping strategies
- Emotional distress
- Functional Status:
- Physical
- Psychological
- Social

Social:
- Family environment
- School/Academic
- Peers
- Parents/sibling responses
- Community

Biological predisposition:
- Disease
- Injury
- Procedures

Psychological:
- Cognitive appraisal
- Coping strategies
- Stress
- Emotional distress

Social:
- Family
- School/Academic
- Peers
- Parents/sibling responses
- Community

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Chronic pain approaches: Out with the old in with the new

"A traditional biomedical model that focuses upon structural and biomechanical abnormalities, most often associated with pain, and its associated disability." 10

"Chronic pain is a complex experience influenced as much by patients' social and cultural environment, beliefs, expectations, attitudes, and the meanings they ascribe to their pain, as it is by biological factors." 11

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The Biospsychosocial Model

"...facilitate the improvement of patients' health and their ability to cope with illness by considering the biological, psychological, and social factors that may influence one's well-being." 12

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What is Cognitive Behavioral Therapy?

• CBT is a form of psychotherapy that addresses the relationships between thoughts, emotions, and behaviors.
• Common treatment modality amongst psychologists:
  – Mental health conditions (anxiety, depression)
  – Chronic health conditions

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Physical + Cognitive Behavioral Therapy (CBT)

Increased levels of fear avoidance and pain catastrophizing leads to decreased physical activity. 

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Can physical therapists deliver CBT?

• CBT is an effective modality for reducing pain intensity and disability in children.15
• Physical therapy is also effective.16,17

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What is Physical Therapy?18

• Physical therapists (PTs) are highly educated, licensed health care professionals who can help patients reduce pain and improve or restore mobility in many cases without expensive surgery and often reducing the need for long-term use of prescription medications and their side effects. Physical therapists also teach patients how to prevent or manage their condition so that they will achieve long-term health benefits. PTs examine each individual and develop a plan, using treatment techniques to promote the ability to move, reduce pain, restore function, and prevent disability. In addition, PTs work with individuals to prevent the loss of mobility before it occurs by developing fitness- and wellness-oriented programs for healthier and more active lifestyles. Physical therapists provide care in a variety of settings, including hospitals, private practices, outpatient clinics, home health agencies, schools, sports and fitness facilities, work settings, and long-term care facilities. Reprint permission required in both cultural therapists.

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CBT + PT can enhance outcomes19

D. P. Thompson et al 2015:
– 57 adult patients randomized to exercise only v. exercise + CBT-based intervention
• CBT group significantly greater:
  • Pain intensity
  • Decrease Pain-related fear
  • Self efficacy
Both with similar improvements in disability

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Archer et al 2015\textsuperscript{20}

- Added CBT to physical therapy treatment post lumbar spine surgery (adults).
- Randomized: Education only or CBT/PT approach provided by a PT.

**CBT Group Outcomes**

- Fear of movement
- Self efficacy
- Improved subjective and objective outcomes measures

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What PT's think about this—Nielsen et al 2014:

Professionally, it certainly has enhanced the way that I practice.

... I'm much more alert to incorporating CBT aspects in my general physio (physical therapy) treatment when it's indicated... and it's actually made a lot of treatments more effective."\textsuperscript{21}

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"...from a physio [physical therapist's] point of view, it is probably not the way we're trained; we're trained to get information quickly whereas the open-ended questions were inviting the clients to explore more and do their own problem solving."21

Think outside the box.

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"I certainly treat some of my patients differently. Now, if they come back and say, 'Look, I haven't done my exercises' instead of saying, 'Oh, naughty patient, you should do your exercises,' I'll say, 'So why do you think that is or what do you think you can do to be able to do these exercises?'"21

Ask open ended questions.

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I think if we hadn't had that [psychologist], we would not have been anywhere near as effective as we were. Because we did bump up against things and we were able to go to her and say, 'And she was able to give us really good strategies to help.'21

Get support.

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Therapeutic Alliance
• Fuentes et al 2014: Supportive patient-practitioner relationship can lead to improved patient outcomes

Pressure Pain Thresholds

Pain Intensity

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Ryan
• 16 year old male
• Diagnosis: post-traumatic distal saphenous nerve neuropathy
• Cannot fully extend R knee
• Initial onset: June 2013
• Plica excision and several blocks, ketamine
• Anxiety disorder

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What didn’t work...
Outcomes

- Full terminal knee extension with all functional activities (gait, ther ex, standing, etc)
- Independent use of coping skills and active pain management strategies
- Unable to return to running due to anxiety and patient goals.
- Ongoing severe pain

Active Pain Management
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**Self-Management in Chronic Pain**

- Teach, practice and reinforce coping skills
- Pain is not a reason to avoid an activity
- Avoid/discontinue use of passive modalities or assistive devices
- Replace patterns of rest with coping skills, stretching and activity

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**Active Coping**

- **Distraction:** Games, talking to friends, watching a movie, going shopping, etc.
- **Cognitive:** Changing negative thoughts/feelings into positive ones.
- **Activity:** Stretching, walking, standing, cooking, bowling, yoga, etc.
- **Relaxation:** Deep breathing, progressive muscle relaxation, guided imagery

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**Emphasis on Self-Management:** Avoid rest or lack of assistive devices or passive strategies.
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Patient #2: Annie

- 19 year old
- Dx: chronic abdominal pain/abdominal migraine/orthostatic intolerance
Other Personal Factors

- **Medical issues:** IBS, disordered eating
- **Psychosocial:** significant social anxiety disorder, home-school since 8th grade, completed GED with goal of attending college
- **Schedule:** Stays in bed most of the day sleeping & watching TV, minimal outings

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Annie’s Goals

**Canadian Occupational Performance Measure (COPM)**

1. Waking up/getting out of bed
2. Going for a hike
3. Going for a walk
4. Archery
5. Fishing

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Treatment Barriers
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Treatment Goals

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Treatment

• Emphasis on aerobic activity, strength training, pacing, active pain management, anxiety accommodations for engagement in physical activity

Outcomes:
- Pain scores
- Subjective and objective performance measures
- Independent activity scheduling/pacing
- Ongoing anxiety treatment

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Exercise Induced Hypoalgesia (EIH):
Healthy adults

- Exercise increases pain thresholds in healthy adults

Mechanism: activation of the endogenous opioid system during exercise
- May be impaired in patients with chronic pain.

Aerobic exercise:
- Higher intensity leads to increased pain relief in healthy populations

Isometric exercise:
- Moderate intensity longer duration of contraction

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Exercise Induced Hypoalgesia: Chronic Pain

Mixed results
- Hypoalgesia in Fibromyalgia but hyperalgesia in Chronic Fatigue Syndrome or widespread pain \cite{24,25}

No evidence for serious adverse effects \cite{26}
- Headaches \cite{23,26,27}
- Functional abdominal pain \cite{24,27}
- CRPS \cite{16,17}
- Chronic Fatigue Syndrome \cite{23,27,29}
- Juvenile Idiopathic Arthritis \cite{27}

Limited evidence:
- Headaches \cite{23,26,27}
- Functional abdominal pain \cite{23,27}
- CRPS \cite{16,17}
- Chronic Fatigue Syndrome \cite{23,27,29}
- Juvenile Idiopathic Arthritis \cite{27}

No evidence for serious adverse effects \cite{29}

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EIH in Adolescents

Minimal Evidence

Stolzman et al 2015 \cite{30}

Exercise may be an effective pain management tool in adolescents – not well studied in patients with moderate to severe pain

EIH demonstrated regardless of fitness levels or weight status

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Subjective v. Objective measures

<table>
<thead>
<tr>
<th>Measure</th>
<th>Spearman Correlation Coefficients ($r_s$)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lower Extremity Functional Scale (LEFS)</td>
<td>-0.316</td>
<td>&lt; 0.001*</td>
</tr>
<tr>
<td>Timed Up and Down Stairs (TUDS)</td>
<td>0.239</td>
<td>0.001**</td>
</tr>
<tr>
<td>Timed Up and Go (TUGS)</td>
<td>0.245</td>
<td>0.001**</td>
</tr>
<tr>
<td>Ten-Point Scale Test (TPST)</td>
<td>-0.190</td>
<td>0.10</td>
</tr>
<tr>
<td>Budekko-D возможности Задачи Моторной Мотивационной (DCT)</td>
<td>-0.113</td>
<td>0.40</td>
</tr>
<tr>
<td>Balance and Agility Standard Score</td>
<td>-0.115</td>
<td>0.40</td>
</tr>
</tbody>
</table>
How do we measure pain?

Numeric Rating Scale (NRS)
- 11 point scale
- Minimum Clinically Important Difference (MCID): 2 points\(^{13}\)
- Does not capture the complex nature of chronic pain (emotional and physical)\(^{14}\)

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**Response Trajectories: Pain\(^{35}\)**

<table>
<thead>
<tr>
<th>Time Point</th>
<th>Responder (38.4%)</th>
<th>Partial Responder (34.4%)</th>
<th>Non-Responder (26.8%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Admission</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Discharge</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 mon follow-up</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 mon follow-up</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 year follow-up</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Simons et al, in submission

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**Functional Disability Inventory (FDI)**

- 15 item self report inventory measured on a 0-4 point scale
- Ages: 8-18
- Higher scores = higher levels of pain severity and depression
- Validated in pediatric chronic pain

Disability level cut offs:
- No/minimal disability (0-12)
- Moderate disability (13-29)
- Severe disability (30-60)

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Response Trajectories: Disability

- Admission
- Discharge
- 1 mon follow-up
- 4 mon follow-up
- 1 year follow-up

Responder (86.8%) Non-Responder (13.2%)

- 2009-2012 n = 191, mean age 14.4; Median admission length: 3.64 weeks; SAS PROC TRAJ, Mixture models

Simons et al, in submission

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Upper/Lower Extremity Functional Scales

- 20 items
- MCID: 9 points
- Useful populations: Upper/Lower extremity chronic pain or CRPS type I/II

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Canadian Occupational Performance Measure (COPM)

- Patient sets 5 goals and evaluates satisfaction and performance on 11 point ordinal scale
- MCID: 2 points
- Validated in adult and pediatric chronic pain
- Useful in all pain populations

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PedMIDAS \(^{39,40}\)

**Gold Standard**
- 6 item questionnaire
- Continuous scale
- Ages: 4-18

<table>
<thead>
<tr>
<th>Score</th>
<th>Disability Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>11-29</td>
<td>Little to none</td>
</tr>
<tr>
<td>30-50</td>
<td>Mild</td>
</tr>
<tr>
<td>&gt;50</td>
<td>Severe</td>
</tr>
</tbody>
</table>

**Clinical Limitations**
- Requires significant memory recall/journaling
- Not useful with multiple pain complaints
- Challenging for children to complete

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**Headache Impact Test – 6 (HIT-6)**

- 6 items rated on a likert-type scale
- Validated in adults: chronic tension type headaches, migraine and healthy adolescents
- MCID: migraine = 6 points; CTTH = 8 points
- Quick, patient friendly, easy to use and score

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**Headache Impact Test-6 Median Scores**

Pre Post One Month Follow-up

- Change = 12

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**Headache Disability Inventory (HDI)**

- 25 items
  - 13 emotional subscale items
  - 12 functional subscale items
- Validated in adult populations (migraine with and without aura, chronic tension type headache)
- Limited research and data, especially in pediatrics
- MCID reported as 29 points
Slide 94

Headache Disability Inventory

Median Scores

<table>
<thead>
<tr>
<th>Admission</th>
<th>Discharge</th>
<th>Follow up 1</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<tr>
<td>Change = 24 points</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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Low Back Pain Measures

Why don’t you go out more?

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Oswestry Disability Inventory

- Modified 9 item likert-type scale (sexual functioning question removed)
- Well accepted and validated in adults with chronic low back pain
- MCID 10 points

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What about abdominal pain?

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<table>
<thead>
<tr>
<th>COPM</th>
<th>Intake</th>
<th>Discharge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Headache COPM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Performance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Headache COPM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Satisfaction</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Abdominal Pain</td>
<td></td>
<td></td>
</tr>
<tr>
<td>COPM Performance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Abdominal Pain</td>
<td></td>
<td></td>
</tr>
<tr>
<td>COPM Satisfaction</td>
<td></td>
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</tr>
</tbody>
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Objective Measures
**Slide 100**

**Bruininks-Oseretsky Test of Motor Proficiency - 2**

- **Age:** 4-21
- **Norm-referenced, standardized**
- **Areas tested:** Fine motor and Gross motor
- **Considerations:** not always reflective of patient deficits/compensation patterns
- **Shows treatment related changes in pediatric chronic pain**

**Domain: Activity Limitations**

**Slide 101**

**Table 1**

<table>
<thead>
<tr>
<th>Measure</th>
<th>Admission</th>
<th>Discharge</th>
<th>Improve/Decline</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>BOT-2 Motor Coordination</td>
<td>10-16</td>
<td>10-16</td>
<td>N/A</td>
<td>P=0.01</td>
</tr>
<tr>
<td>BOT-2 Balance</td>
<td>16-18</td>
<td>16-18</td>
<td>N/A</td>
<td>P=0.01</td>
</tr>
<tr>
<td>BOT-2 Body Coordination</td>
<td>10-17</td>
<td>10-17</td>
<td>N/A</td>
<td>P=0.01</td>
</tr>
<tr>
<td>BOT-2 Upper Limb Coord.</td>
<td>10-17</td>
<td>10-17</td>
<td>N/A</td>
<td>P=0.01</td>
</tr>
<tr>
<td>BOT-2 Lower Limb Coord.</td>
<td>10-17</td>
<td>10-17</td>
<td>N/A</td>
<td>P=0.01</td>
</tr>
</tbody>
</table>

Logan et al 2012

**Slide 102**

**BOT-2 Strength/Agility**

**BOT-2 Body Coordination**

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Timed Up and Go

- Time to walk stand, walk 10 feet, turn, sit down
- Ceiling effect
- Show treatment related changes in pediatric chronic lower extremity pain

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Timed up and go

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Timed Up and Down the Stairs

- Time to stand, ascend/descend 9 stairs, sit
- Ceiling effect
- Developed for children with cerebral palsy
- Shows treatment related changes in pediatric chronic lower extremity pain
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Timed up and down the stairs

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**Six Minute Walk Test**

- Distance ambulated in 6 minutes
- Shows treatment related changes in pediatric chronic lower extremity pain
- Ceiling effect: Useful in any chronic pain populations with low physical functioning

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**Six Minute Walk Test**

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**Symptom-Limited Modified Bruce Protocol**

- Performance: 9 stages, 3 minutes each, patient-terminated
- Data to collect: HR response, maxHR, Borg, pain scores, patient symptoms/rationale for stopping the test
- Useful in any chronic pain population with moderate to high physical functioning
- MCID unknown & not validated in pediatric chronic pain

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**Modified Bruce Protocol Total Time Completed (minutes)**

<table>
<thead>
<tr>
<th></th>
<th>Pre</th>
<th>Post</th>
<th>One Month Follow-up</th>
</tr>
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<tbody>
<tr>
<td><strong>Total Time</strong></td>
<td>12</td>
<td>12.5</td>
<td>13</td>
</tr>
<tr>
<td><strong>Completed</strong></td>
<td></td>
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<td></td>
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**Chronic pain is best approached from a biopsychosocial perspective.**

**Promote activity, self-management, active coping.**

**Use subjective and objective measures to assess progress.**

**Think outside the box.**


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Assessment and Treatment of Sensitization and Chronic Pain

Anna Bruehl, MS, OTR/L

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**DISCLOSURE**

THE SPEAKER CANNOT IDENTIFY ANY CONFLICT OF INTEREST AND HAS NO RELATIONSHIPS THAT SHOULD BE DISCLOSED.

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**Objectives**

- Sensitization and chronic pain
- Impact of sensitization on function
- Clinical assessment
- Clinical treatment
- Sensitization management
- Evidence based practice

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**Characteristics of Sensitization**

Sensitization is a typical response that occurs after an injury is acquired. The area of injury becomes hypersensitive as a means of protection.

- **Allodynia**: Pain in response to non-painful stimuli.
- **Hyperalgesia**: Exaggerated pain in response to a painful stimuli.
- **Pathological Pain**: Painful response even when injury is healed.

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Peripheral sensitization

- Contributes to the pain hypersensitivity found at the site of tissue damage and inflammation.  

Central Sensitization

- Contributes to pain hypersensitivity beyond an injured area.

Characteristics of Sensitization

Evidence of Sensitization

Pediatric patients with chronic pain

- Exhibit heightened pain sensitivity to multiple modalities compared to healthy controls.
- Demonstrate increased sensory detection thresholds (widespread hypersensitivity) to innocuous vibration and thermal detection modalities via Quantitative Sensory Testing.

Impact on Function

Mobility

- Decrease strength
- Decreased ROM
- Edema

Activities of Daily Living

- Leisure/Play
- School performance
- Self-care/hygiene
- Community mobility/participation
- Rest and Sleep
Current Practice Limitations

- Lack of understanding on the anatomic origin of the pain complaints.
- Limited available diagnostic tools.
- Possible therapy modalities are largely unexplored.
- The gap between basic knowledge and clinical benefits remains large due to a lack of clinical research.

Assessment

Assessment of Sensory Function

- Sensory Acuity
  - Touch
  - Thermal
  - Sharp/Dull
- Hypersensitivity
  - Pain response with exposure to stimuli
  - Sensory/Pain Perception
- Physical features
  - Edema
  - Abnormal hair/nail growth
  - Skin discoloration
- Body Schema
  - Size
  - Shape
  - Feeling
Quantitative Sensory Testing

Two Point Discrimination
- determines how finely an area of skin is innervated.

Von Frey Monofilaments
- measures touch sensation and can determine hyper- or hypo-aesthesia.

Tuning fork
- 128 hertz is the norm to measure vibration sensation
- Disappearance threshold

Pressure algometer
- Touch pressure threshold
- Pain pressure threshold

Temperature Probes
- Thermometer controlled temperature to measure hot and cold discrimination and detection

Sensitization Testing

Pain Sensitivity Questionnaire (validated in adults)

Pediatric Pain Sensitivity Tool (validated in pediatrics)
- Subjective questionnaires that assess patients pain sensitivity to painful and non-painful general occurrences.

BATH Body Perception Disturbance Scale (validated adults)
- Captures changes in self-perception of the affected limb and the presence of disturbances in body perception.
Clinical Ways to Measure Hypersensitivity

- **Direct application** of graded textured stimuli. Can be applied to any body site.
- **Immersion** of affected limb in graded textured particles. Limited to distal limb.
  - Patients rate their pain response

Sensory Diagram
Patients illustrate location of sensitivity on their body and rate the level of sensitivity.

- yellow=feels weird
- green=minimal
- blue=moderate
- pink=severe

Treatment
I still have no idea

What I'm doing
Slide 139

Desensitization Treatment

• A technique used to modify how sensitive an area is to a particular stimuli.
• Directly applying non-noxious stimuli over the sensitive area. 12, 13

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Desensitization Outcome

• The brain acclimates to the sensation, thereby gradually decreasing the body’s pain response to the particular stimuli. 13
• Increases the pain threshold over sensitive area and decreases discomfort. 14
• Provides tactile information regarding the precise shape and size dimensions contributing to a more accurate somatosensory representation. 13
• Helpful in perceiving the affected limb in a more normal way. 16

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“ It was by walking that the barefoot boy toughened his feet”
—Sterling Bunnell, 1984

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Active pain management strategies

- Fidget
- Distraction
- Deep breathing
- Stretching
- Moving

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Desensitization Tools

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Methods of Application
Graded Progression

Start where the patient is most comfortable:
1. Brief static contact (i.e. tapping)
2. Prolonged static contact (i.e. applied force to area)
3. Brief dynamic contact (i.e. strokes)
4. Prolonged dynamic contact (i.e. massage)
5. Immersion (i.e. bath, tactile bin)
6. Sporadic/unpredictable contact (i.e. shower stream)
7. Functional application and reintegration

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Methods of Desensitization

Visual awareness or Visual occlusion?
- Encouraging patient’s to look at the limb at the time of skin contact, provides corrective visual input of the limb.  

Patient administered or therapist administered?
- Encouraging patients to touch the affected area where tolerated provides corrective sensory inputs to accurately update body scheme.

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Attention vs. Distraction

Benefits of Attending
- Cortical reorganization
- Normalizes body schema

Benefits of Distraction
- Increased tolerance
- Inhibits fear response
- Normalizes response, overriding pain response

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Goransson & Caderlund, 2011

Study looked at the effects of desensitization after surgery/injury of the UE in adults. Texture patient barely tolerated was massaged over the sensitive skin area 3x/day until numbness occurred (2-5 min).

- Took 1-3 weeks before patients progressed to next texture.

Results: After 6 weeks, patients showed significantly reduced pain at rest, with use/touch, decreased size of sensitive area and improved occupational performance.

Hardy et al. 1982

Study looked at the effects of desensitization on traumatized hand in adults. Desensitization: Completed 5 level program progressing from tolerating static to more dynamic stimuli to activity/work reinstatement.

Results: 6-8 weeks

- 75% reported normalized sensation. 25% reported occasional hypersensitivity that did not interfere with work.
- Grip and pinch strength improved by at least 50% in all patients.
- 85% returned to work without limitations within 8 weeks of treatment.
Sherry et al. 1999

Study looked at the impact of intensive exercise therapy, including desensitization treatment for children with CRPS.

- Exercise therapy: 5-6 hr/day (PT/OT x 4hrs and hydrotherapy x 1-2hrs) over a mean of 14 days.
- Desensitization: towel rub, hand massage, textured fabrics, contrast baths, street clothing, sports gear.

Results:
- 92% of the 103 children regained full function and complete pain resolution immediately after.
- 88% were fully functional with no pain after 5 years of follow up.

Treatment Outcome

Better outcomes when desensitization is completed within the context of a functional activity.

Treatment regimens that include desensitization, active and passive range of motion, exercise, and functional activities in children and adolescents have been found to lead to good prognoses.

Desensitization Protocol

- Begin with where the patient is most comfortable.
- Application of stimuli follows a progression; soft to coarse.
- Short periods of time: 10-15 min.
- Frequently throughout the day: 3-4x.
- Progress once the patient can tolerate the stimuli for at least 10 consecutive minutes.
- Involve the non affected extremity to generalize normal response.
- Functionally integrate application of stimuli.
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**Sensitization Home Program**

**Stimuli:** Pick 3-5 that are tolerable but irritating.

**Duration:** 2-10 minutes each for a total of 10-20 minutes of direct application of stimuli to affected area.

**Frequency:** 3-4x/day

**Incorporate functional exposure to stimuli**

- **When to maintain:** Tolerating <10 minutes of continuous application or showing evidence of aversive behavioral responses.
- **When to progress:** Tolerating >10 minutes without aversive behavioral response.

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**Case Study: Medical History**

- 16 y.o female dx with LLE CRPS in August 2014 and was treated for recurrent pain flare in March 2015.
  - Multiple inpatient stays (Atlanta then BCH)
  - L femoral nerve catheter placement and epidural catheter with limited benefits
  - Outpatient PT without progress with mobility/desensitization treatment
- Admitted to Mayo Family Pediatric Pain Rehabilitation Center (PPRC) September 8th, 2015.
  - Not tolerating wearing pants, sheet, shower stream, wind, or vibration
  - L knee flexion/A/PROM 40 degrees
  - Ambulating using crutches

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**Case Study: Treatment**

- 1-2 hrs/day of OT, PT and Psychology 5x/week
  - OT: desensitization, ADLs, functional reintegration
  - PT: mobility, ROM, strength
  - Psychology: coping skills, exposure tx, family dynamics

**PT/OT Home Exercise Program**

- Mon-Fri 1x/day
- Sat and Sun 2x/day

OT: desensitization x 30 min, ADLs, clothing management plans

PT: strengthening, stretching, mobility training
Case Study: Desensitization Progression
• Static light/soft touch (tapping, sheet, towel)
• Dynamic soft texture touch (vibration, Wilbarger brush)
• Static temperatures (hot/cold pack)
• Immersion (water, tactile bins, fluidotherapy)
• Functional application
• Shower stream
• Dynamic coarse texture (sharp edge of ruler, bumpy massager)

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Canadian Occupational Performance Measure

1. Shower
2. Ride bike
3. Play Basketball
4. Babysit
5. Attend to school work

Tactile Stimulation Discomfort Level

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Case Study: Body Perception

**BATH Body Perception Disturbance Scale**

**Admission: 16/57**  **Discharge: 11/57**

- No longer identified limb as larger, heavier or warmer.
- Limb felt more a part of body
- More positive emotional feelings towards limb

Case Study: Functional Progress

Following 6 weeks of multidisciplinary treatment:

- Wearing ALL articles of clothing
- Bathing LLE with shower stream
- Shaving LLE
- Sleeping with covers
- Complete ALL dressing in standing
- Achieved 130 degrees of L knee flexion A/PROM

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When Initiating Desensitization Treatment...

- **Educate** patients on ways to independently manage their pain response to support functional participation.
- Treatment should be administered up to 10 minutes, 3-4x/day.
- Progress towards functional exposure to stimuli.
- Encourage patient to **visually attend** and self-administer stimuli to normalize body schema and incorporate non-affected body part.
- Provide treatment in conjunction with physical and psychological intervention to optimize functional outcome.

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**Slide 164**

5. Sethna NF, Meier PM, Zurakowski D, Berde CB. Cutaneous sensory abnormalities in children and adolescents with complex regional pain syndromes. Pain. 2007; 131:153-161

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An Interdisciplinary Approach to Pediatric Pain
(Or why “Reframe!” is the most common word heard in our gym!)

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APTA/CSM February 2016

No conflicts of interest or disclosures

"Yes, I am employee of the month again. And yes, I'm the one who chooses the employee of the month. And no, I don't see a conflict of interest."

Wait, why is there a psychologist here?
Slide 172

**BioPsychoSocial Model of Chronic Pain**

- **Biological**
  - Disease
  - Injury
  - Procedures
  - Biological predisposition

- **Psychological**
  - Cognitive appraisal
  - Coping strategies
  - Stress
  - Emotional distress

- **Social**
  - Family, peer, community
  - Parental/sibling responses
  - School/Academic
  - Peers

- **Functional Status**
  - Physical
  - Recreational
  - Academic/Job
  - Social
  - Psychological

*Varni, 1984*

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**BioPsychoSocial Model of Chronic Pain**

- **Cognitions**
  - Emotions
  - Social context

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Slide 174

**Psychosocial factors influencing the chronic pain experience**
**Premorbid Psychological Correlates**

- Who child was prior to pain onset can affect:
  - Vulnerability to persistent pain condition
  - Transition of acute pain to chronic pain
  - Treatment course and response to intervention

- Factors include (but are not limited to):
  - Premorbid anxiety and/or depression
  - Internalizer, Minimizer, Somaticizer
  - Perfectionistic
  - Sensitive temperament/"Sensory" kid
  - Generally avoidant coping style

**Pain-Specific Psychological Correlates**

- Fear of pain
  - Fear itself
  - Avoidance of activities
- Pain catastrophizing
- Pain acceptance
- Coping style
  - Active vs. Passive

**Environmental Psychological Correlates**

- How others respond to child’s pain:
  - Protective/Overly solicitous
  - Minimizing/Invalidating
  - Possibility of secondary gain
- Environmental Stressors, such as:
  - Family environment (e.g., conflict?)
  - School/Academic stressors
  - Peer Relationships
Psychological Treatment Targets:

• Address unhelpful thoughts about and emotional responses to pain
• Teach a self-management approach to pain through active coping strategies/skills
  – Foster ownership and independence
• Support engaging in valued activities and relationships, even in the presence of pain
• Reduce parental attention and protective responses to pain

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First... a fact check!

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So, if not on the couch, how do psychologists address those targets?

• Cognitive-behavioral therapy (CBT) treatment approaches have demonstrated efficacy in pain rehabilitation (Wetherell et al., 2011).
  • Focused on how person’s cognitions, emotions, and behaviors are connected and interact with one another
• Offshoot of CBT, Acceptance & Commitment Therapy (ACT; Wicksell et al., 2009), emerging as effective
  • Aimed at improving functioning by increasing the ability to act effectively in the presence of distress (and pain)
Slide 181

CBT as Self-Management Approach

- Group of evidence-based treatment strategies
- Usually short-term, involves homework
- Teaches specific techniques
  - Requires pt’s effort for them to work!
- Collaborative with patient → empowerment
- Goal-oriented to resolve current (present-day) problems, step-by-step
- For pain, focus is on management, not cure

Slide 182

The Cognitive Triangle

Thoughts

Feelings → Behavior

Slide 183

What we think: “I can’t cope”

What we do: Avoid

How we feel: Worried, scared

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Unique relevance for patients with pain

Modified with first author permission; Simons et al., 2012

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“Coping”
- Using a tool or strategy to actively and independently manage pain and keep going
- *NOT* plowing through, biting the bullet, grin-and-bear-it
  - Results in boom-bust, not sustainable
- *NOT* intended to eliminate or even reduce pain

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Passive (vs. Active) Coping
- Non-preferred!
- Waiting until it gets better on its own
  - Rest, lay down, nap
  - Activity avoidance
- Waiting until someone or something to help
  - Meds
  - Chiropractor/Massage
  - TENS unit

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Active Coping

- Distraction
- Breathing/Relaxation
- Cognitive/Thinking Tools
- Active Exercise

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What does all this mean for PTs?

- **Our shared goal**: help youth return to pre-pain functioning via engagement in previously avoided activities and adopting a self-management approach
  - Increase knowledge base for collaborating with psychology
  - Increase comfort with operating in the “gray areas”
  - Incorporate basic psychology strategies into practice

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“DO-ABLE” COGNITIVE INTERVENTIONS
Slide 191

Reframing Thoughts

• Changing unhelpful thoughts into more helpful thoughts

• #1 rule - New thought must be:
  – Realistic/true
  – Believable

• Look for the facts
  – Assess likelihood
  – Perspective taking

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Reframing examples #1: Let’s try it!

• There’s no way I can do (exercise) at home!
  – If I was able to do it at PT, I bet I can do it at home where I’m even more comfortable.

• I can’t even walk up the stairs!
  – I’m not able to walk up stairs yet, but I’ve made progress in other areas to get me ready for it.

• Pain is ruining everything!
  – Pain has gotten in the way of lots of things, and that’s a bummer, but doing this work is helping me get back to my life!
Slide 193

Reframing examples #2: Let’s try it!

- If I do (exercise), I’ll reinjure myself/make pain worse.
  - While there’s a chance pain could show up while I’m doing this, I have strategies to deal with it and the chance of injury is low, especially with my PT right here.
- No one believes me.
  - Even though a few classmates have been rude, most of my family and friends have tried to be really supportive.
- Nothing will be able to help me.
  - I’ve tried things that haven’t really helped so far, but it’s possible that I could gain something useful from this (treatment/exercise).

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Technically, the glass is always full.

Slide 195

The Patient’s Dilemma (Wicksell, 2007)

Goal

- No pain

Values

- Dancing
- Being in school
- Swinging tennis

Costs

- Pain
- Unpredictability

Benefits

- No dancing
- Not seeing friends
- No school

Pain
Steps of Problem Solving

Identify the problem
Brainstorm possible solutions
Evaluate the solutions
Choose a solution to try
Review how it worked (if not, go around again!)

“DO-ABLE” BEHAVIORAL INTERVENTIONS

The ABC’s of Behavior
- Antecedents
- Behaviors
- Consequences
  - Reinforcement
  - Punishment
- A note on: “He’s/She’s/It’s so behavioral!”

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**Slide 199**

The Power of Reinforcement

- Reinforcement increases likelihood of desired behavior.
- Can come in many forms (praise, attention, rewards).
- Preferable to punishment.
- Tips:
  - Reinforce behavior, but individualize to person.
  - Clarify link between behavior and reinforcement.
  - Be precise about behavior to reinforce.
  - Be consistent with reinforcement.
  - Focus on desired behavior.

**Slide 200**

Application: The Token Economy

Child earns points/tokens for success in desired behaviors.
Child exchanges tokens for desirable items or activities.

**Slide 201**

Behavioral (Point) Plan

- Utilizes token economy (tokens = “points”):
  - Provides frequent opportunities to perform tasks/goals.
  - Bonus points = the catch all.
- Selecting appropriate goals (“target behaviors”):
  - Phrase goals positively.
  - Choose S.M.A.R.T. goals.
Rules of Thumb for Goal-Setting

- What do you want to accomplish?
- How will you know you've done it?
- Is this something you can actually do?
- Is it worth doing?
- By when will this goal be accomplished?
Tidbits for Increasing Motivation and Behavioral Engagement

- Setting & Breaking Records
  - Appeals to competitive kids especially
- Incorporate play for younger patients
  - E.g., Chalk art
- Access challenging tasks indirectly at first
  - E.g., Choreograph a dance with HEP moves
- Directly assess and enhance motivation
  - Importance & confidence

(Extinguishing) Pain Behaviors

- What about decreasing likelihood of bx?
  - Pain behaviors (e.g., verbalizing, grimacing, wincing, limping, guarding.)
- Inattention is the name of the game!
  - Attention (+/-) reinforces pain bx
  - Beware the extinction burst!
- How do we motivate?
  - Reinforce preferred bx instead

Avoidance Ninjas

- Avoidance: passive strategy for coping with anxiety, especially pain-related fear
  - Not always apparent; may be be subtle, expressed as preference, and/or involve compensatory bx
Slide 211

Activity Ladders

• Utilizes principles of:
  – Gradual exposure
  – “Just-right challenge”
  – Successive approximation

• Created and modified in collaboration w/ pt
• Builds trust w/ provider
• Builds confidence & self-efficacy

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Developmental Considerations

• Ultimate treatment goals are broad:
  – Patient takes ownership of pain management
  – Patient learns to cope independently with pain

• Scaffolding: Type of gradual exposure
  – Modeling by therapist or another pt who copes well
  – Providing pt with instruction, prompts, reminders in order to cope effectively
  – Pt demonstrating skills inconsistently
  – Pt demonstrating skills consistently ➔ gradually fade support

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Developmental Considerations

• ALL patients need to:
  – Walk before we run
    • Literally & figuratively
    • Physically & psychologically
  – Pace ourselves: it’s a marathon, not a sprint

• Therapists should include youth input
  • Promotes self-efficacy and empowerment
  • Allows for patient control where control is possible
  • Director (“Do A, B, & C”) ➔ Facilitator

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Developmental Considerations

- Determine by age and/or developmental level:
  - How much input into tx course obtained
  - Method of obtaining input about tx
  - Expectation of (and what is meant by) independent
  - Process/speed of weaning supports

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But First... Empathy

- Ability to step into another’s shoes, understand their feelings and perspectives, and use it to guide actions

Slide 216

Cultivating empathy

- Have you ever tried to change the way you do something? If so, reflect on that experience.
  - Even with motivation and knowledge change will help you, change can be difficult and scary!
  - You must give up old way first, and then try a new way. In between, you’re basically in free fall! Ahh!
- Remember this when asking youth and their families to change their responses to pain

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Psychological factors play crucial role in chronic pain presentation and treatment; we all must attend to these factors to provide truly effective treatment!

PTs and psychologists share big-picture treatment goals for youth with chronic pain: improving functional ability, self-management of pain, and independent coping.

Regardless of specific techniques used, it’s imperative to make developmental considerations, function in the “gray areas,” and above all, cultivate empathy!

Interdisciplinary Treatment Approach to Pediatric Pain

Cognitive-behavioral interventions are effective for youth with chronic pain and are valuable to PTs for modification and use in therapy.

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References