Pain with Movement: Transforming Theoretical Models to Physical Therapist Practice

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Combined Sections Meeting 2019
Washington, DC, January 23 – 26, 2019

Objectives

- To describe current conceptual models for pain with movement and subsequent movement adaptation
- To interpret sensory, psychological and motor influences of pain with movement
- To distinguish pain with movement and subsequent movement adaptations through clinical measurement tools
- To assess pain with movement in common orthopaedic conditions

Pain with Movement and Movement Adaptation Models

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Disclosure

- No relevant financial relationship exists

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People in PAIN, MOVE differently




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Research and Clinical Questions

- What factors contribute to individual differences in motor/movement behavior?
- Why do changes in motor/movement behavior persist?
- How is recovery defined?

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Research and Clinical Questions

- Limited evidence to answer these questions
- Decreased effectiveness of current pain management approaches
- Need more research to effectively:
  - Treat pain AND optimize movement
  - Prevent long-term disability

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Pain With Movement

- Conceptual models integrating pain with movement are critical to support research and clinical practice

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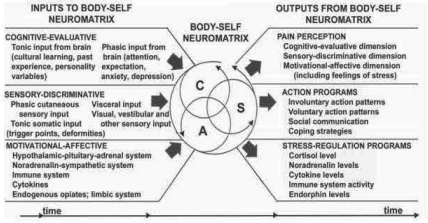
Nervous System Pain Processing



Neuromatrix Model (Melzack, 1999)

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Nervous System Pain Processing

- Lots of detail on pain processing (inputs)
- Motor behavior (action programs) is vague
- Does not address impact of system relationships over time

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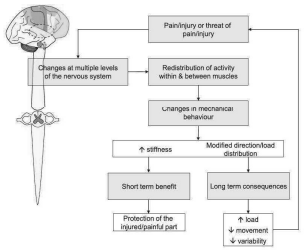
Movement Changes in Response to Pain



Motor Adaptation to Pain Model (Hodges & Tucker, 2011)

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Movement Changes in Response to Pain

- Has more detail on motor and movement changes
- Multiple levels; shows variability
- Nervous system changes are vague

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Need for an Integrated Model

- Should characterize pain processing *and* movement
- Should *not* treat pain and movement as separate entities
- Should acknowledge potential for multiple recovery endpoints

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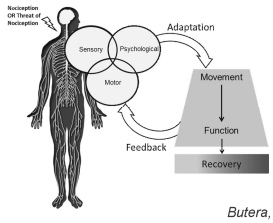
A Model for Integrating Pain With Movement



Butera, George, & Fox. PTJ. 2016

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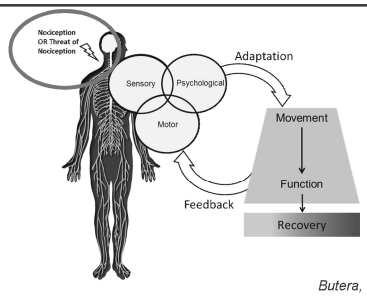

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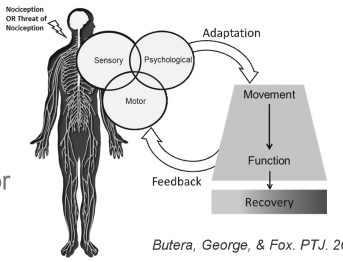
Integration #1: Nervous System Processing

-inclusion of a motor component



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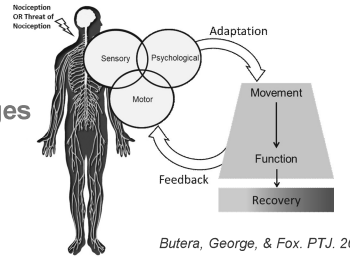
Integration #2: Movement Changes

-consideration of function



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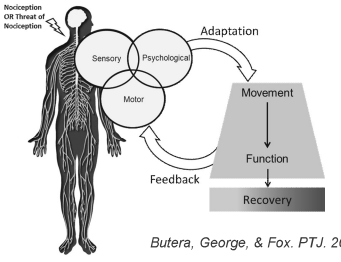
Critical Addition

-feedback loop



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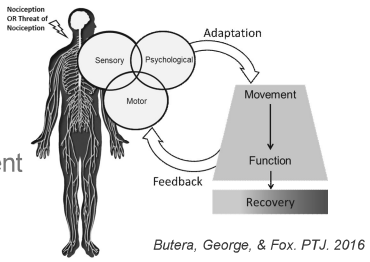
Critical Addition

-recovery component



Butera, George, & Fox. PTJ. 2016

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Significance of an integrated model

- Characterizes pain processing alongside movement responses
- Movement is dynamic and leads to potential changes in function
- Changes in movement and function impact recovery over time

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Next Steps in Research

- Utilize integrated models to test hypotheses *longitudinally* in *clinical populations*
- Identify individualized neural risk factors and/or potential treatment targets
- Develop and test personalized pain management approaches to enhance pain-relief and optimize functional outcomes

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Next Steps in Clinic

- Increase physical therapists' understanding of the relationship between pain and movement
- Implement comprehensive, personalized treatment strategies into clinical practice
  - Measure/monitor pain factors
  - Measure/monitor movement and function
  - Evaluate pain during movement (movement-evoked pain)
- Focus should be on treating pain while also optimizing movement and function

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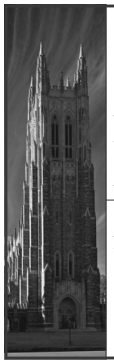

Sensory & Psychological and Influences of Pain with Movement

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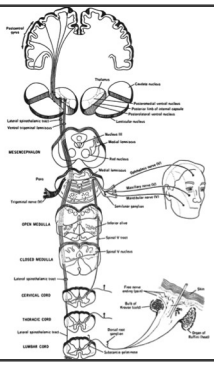
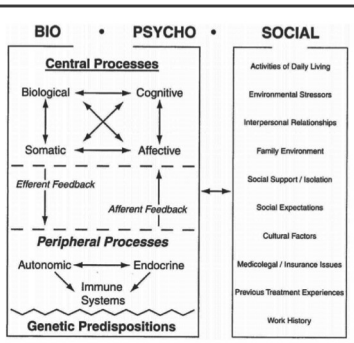
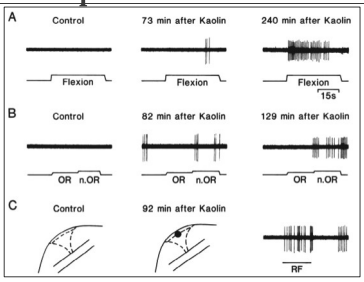




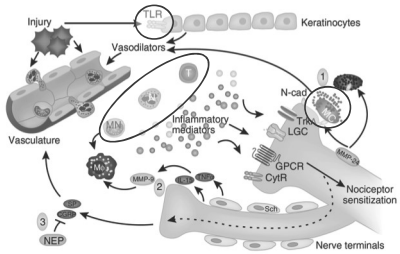
(Gatchel, 2004, 2007)

'Silent' Nociceptors



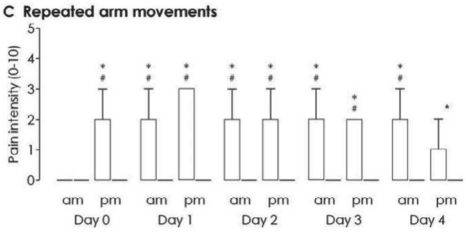
(Schaible 1988)

The Immune System



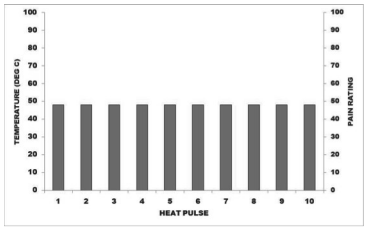
(Ren 2010)

The Immune System



(Bergin 2015)

Pain Modulation



Pain Modulation

(Wideman 2013)

Mechanical Pain Modulation:
R^2 = .09, p< .01

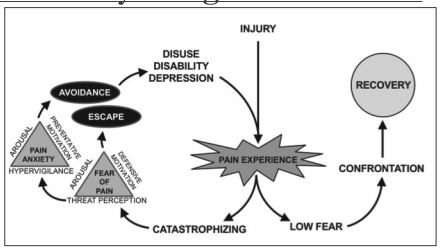
Pain Modulation

Coronado, 2013:
Shoulder Pain with Movement
R^2= .05, p< .001

Rakel, 2015:
Knee Pain with Movement
R^2 = .16, p< .01

Simon, In Review:
Low Back Pain with Movement
R^2= .13, p< .01

Pain-Related Psychological Distress



Pain Catastrophizing

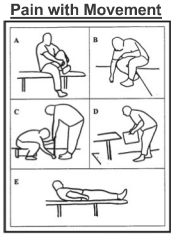
(Wideman 2013)

Mechanical Pain Modulation:
R^2 = .09, p< .01

Pain Catastrophizing:
R^2 = .05, p< .05

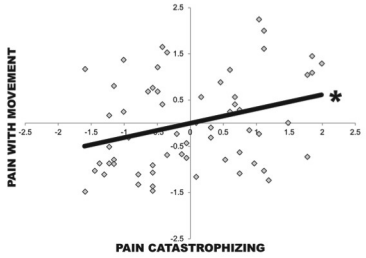
Pain Catastrophizing

(Sullivan, 1995)



(Strand, 2002)

Pain Catastrophizing



(Simon, 2016)

Summary

- Multiple biopsychosocial influences on pain with movement:

Nociceptor activation

The Immune System

Pain Modulation

Psychological Distress

Thank You!

@DukeMSK

Duke Clinical Research Institute
Musculoskeletal Research Team

Moving with Pain

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Disclosure

- No relevant financial relationship exists

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Objectives

- To explore the relationships between pain and movement through biomechanical, clinical, and pain models.
  - Mechanistic
  - Movement Analysis
  - Integration of models.

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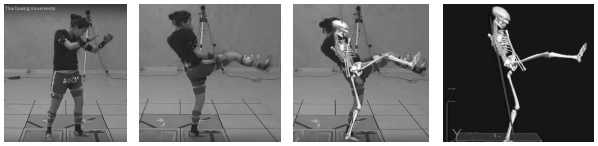
Movement

Series of external and internal forces acting on joints



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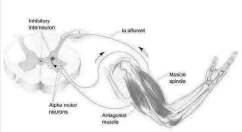

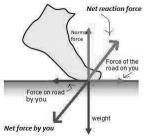

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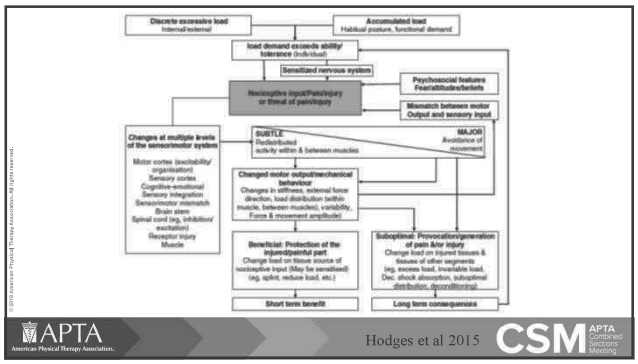
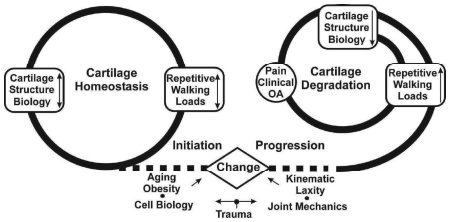
SUBTLE Redistributed activity within & between muscles		MAJOR Avoidance of movement
Redistribution of activity within/between muscles	Adoption/maintenance of provocative movement/posture	Avoidance of movement
Modification of coordination of muscle activity	Guarded/protective movement	Reduced force output
Subtle modification of force direction or stress distribution	Reflex inhibition	Avoidance of function
Modification of loading at adjacent regions	Enhanced or reduced movement variation	Activity and/or participation limitation

APTA American Physical Therapy Association. Hodges et al 2015 CSM APTA Combined Sections Meeting



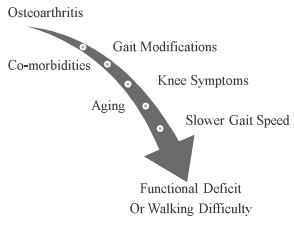
Hodges et al 2015

Mechanical OA Model



Andriacchi et al 2009

Integrating OA and Pain Models



Effects of Gait Speed on Gait Parameters

Muscle activation and co-contraction at 1.0, SS, and Fast gait speeds.

		1.0	SS	Fast
OA (NoDiff v. Control)	Muscle activation	MQ LQ	MQ LQ	MQ
	Co-contraction	MQMH	MQMH LQLH	None
Walking difficulty (Diff v. NoDiff)	Muscle activation	None	None	None
	Co-contraction	None	None	None

Gait Observations

- Symptom-avoidance gait strategies
  - Antalgic Gait Strategy
  - Knee Stiffening Gait Strategy

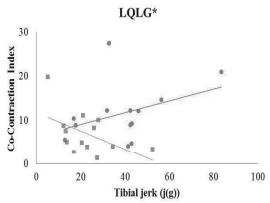
Pain → Stiffness → Instability → Self-Reported Walking Difficulty

Symptom-avoidance gait strategies

- Antalgic Gait Strategy
- Knee Stiffening Gait Strategy

- ↓ Sagittal Plane Knee Excursion
- ↑ Knee Adduction Moment
- ↑ Limb Dynamics
- ↑ Co-contraction

Sensor Data



- Main Effect of Group: p = .05
- Main Effect of LQLG: p = .05
- Interaction Effect of Group*LQLG: p = .025

Integrating pain and movement theories

- Those with self perceived walking difficulty use different modification strategies than with no walking difficulty.
- These modifications may be the most apparent with the tibia.
  - Theories:
    - Decreased proximal stability leading to increased at more distal ends.
    - Open loop vs. closed loop
      - Walking difficulty = open – overshoot of the neuromuscular system, all or none
      - No Walking difficulty = closed – effective and efficient with neuromuscular system, able to gage and adjust
- Self-perceived walking difficulty exists even though they are able to walk at fast and functional gait speeds. Gait parameter differences appear to attenuate when walking at fast gait speeds.
- Gait adaptations in those without walking difficulty, although may have knee OA related symptoms, appear to be more useful than those with walking difficulty.

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Intervention Strategies and Clinical Applications

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Disclosure

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Learning Objectives

After this lecture the participant will be able to…

- Identify different intervention strategies and clinical applications to be applied to reduce fear of movement

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Why addressing fear?

Acute pain	Chronic pain
• *E.g tendon rupture* Olsson and his co-workers found a negative correlation between kinesiophobia and functioning 12 weeks after an Achilles tendon rupture *(Olsson et al 2012)*	• *E.g chronic low back pain* 70% of the patients with low back pain in an orthopaedic setting report a high degree of fear of movement *(Lundberg, 2006)*

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Who is afraid of moving?

Cardiac Rehabilitation

Relevance of Kinesiophobia in Relation to Changes Over Time Among Patients After an Acute Coronary Artery Disease Event

Maria Bäck, PhD; Mari Lundberg, PhD; Åsa Cider, PhD; Johan Herlitz, PhD; Bengt Jansson, PhD

High degree of kinesiophobia after lumbar disc herniation surgery

Gunilla Limbäck Svensson, Mari Lundberg, Hans Christian Östgaard & Gunilla Kjellby Wendt

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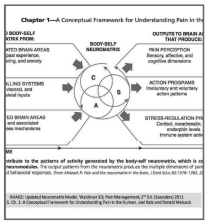
Rationale for fear reduction



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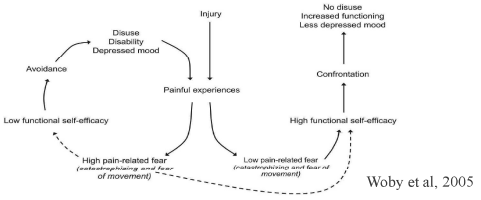
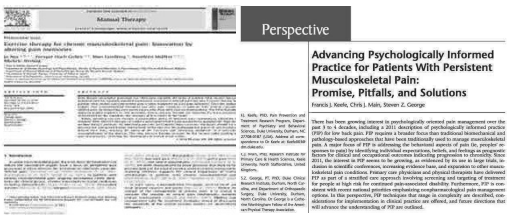
Theoretical framework



Woby et al, 2005

How can we decrease fear?



Manual Therapy

Perspective

Advancing Psychologically Informed Practice for Patients With Persistent Musculoskeletal Pain: Promise, Pitfalls, and Solutions

Francis J. Keefe, Chris J. Main, Steven Z. George

What do WE need to learn?

First, therapists require an **in-depth understanding of pain mechanisms** (Butler and Moseley, 2003)

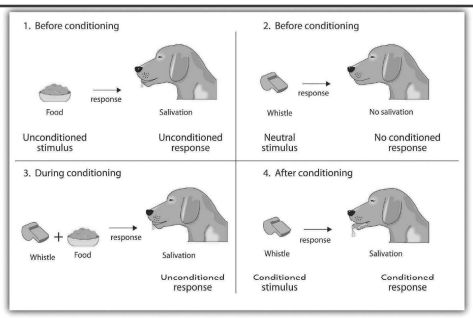
and the **dysfunctional central nociceptive processing** in those with chronic musculoskeletal pain (Woolf and Salter, 2000; Woolf, 2011)

What do WE need to learn?

Psychological informed…

Pain neuroscience education…

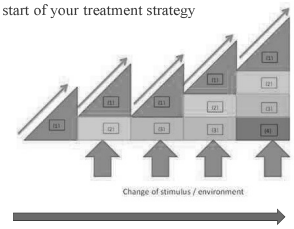
Cognitive exposure…



http://changecom.files.wordpress.com/2012/12/classical-conditioning.jpg

Application: Prehabilitation

Add the pain perspective
-at the start of your treatment strategy



Therapists are fearful

Physical therapists' kinesiophobic beliefs negatively influence lifting capacity of healthy adults (Lakke et al, 2015)

More than two-thirds reported that they would advise a patient to avoid painful movements (Linton et al, 2002)

References

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