COMBINED SECTIONS MEETING 2018

COURSE PROPOSAL

TITLE: Biomarkers for Low Back Pain: Translating the Research into Clinical Practice

COURSE DESCRIPTION

Low back pain (LBP) is known to be complex and multifaceted. Although the tools and methods used in research of LBP have changed to reflect this complexity over the years, commonly used clinical tools for physical therapy assessment of LBP have remained largely unchanged. The speakers will highlight some of the tools and methods used in their research, discuss the potential for added value to assessment and management of LBP provided by use of these tools and methods, and propose strategies for clinical implementation. Specifically, measures of respiration, cardiovascular function, autonomic nervous system function, and pain processing will be discussed.

COURSE OBJECTIVES

Upon completion of this course, you will be able to:

1. Discuss current knowledge of the relationship between cardiopulmonary function, ANS function, and pain processing and LBP
2. Describe the rationale for incorporating measures of breathing, cardiovascular function, ANS function, and pain processing into clinical assessment of LBP
3. Choose appropriate tests and measures for assessment of breathing, cardiovascular function, ANS function, and pain processing

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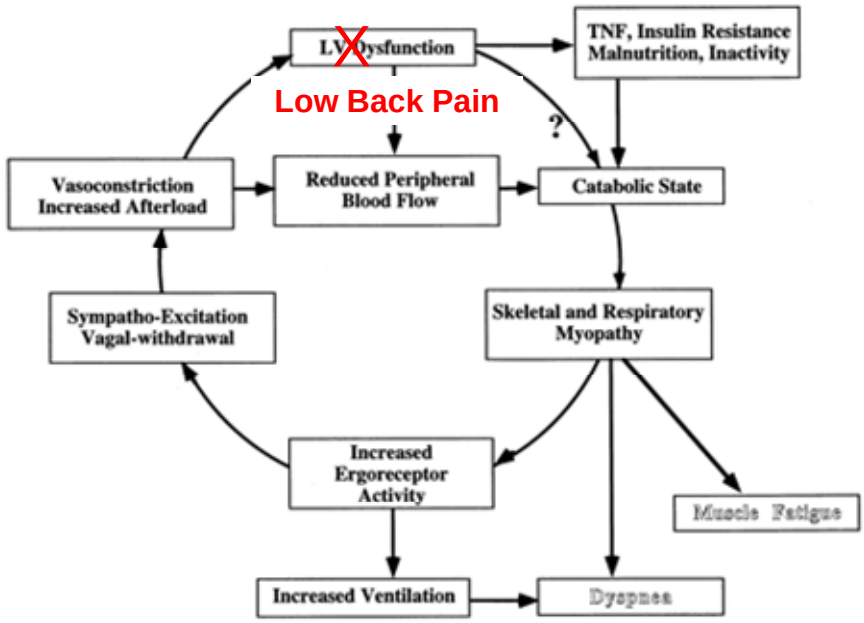
OUTLINE (TOTAL TIME – 2 HOURS)

1) Introduction and clinical relevance (5 min) - Wong
    a. The current gap between clinical practice and research
2) Breathing and LBP (25 min)- Wong
    a. Models for understanding the relationship between breathing and LBP
        i. Biomechanical model
            1. Diaphragm as a key muscle for respiration, postural control, and visceral function
        ii. Biochemical model
            1. Respiratory gases and body pH
        iii. Allostasis and allostatic load model
            1. Bidirectional relationship between ANS function and breathing
    b. Tools and methods for measuring breathing
        i. Maximal respiratory muscle performance
            1. Maximal inspiratory pressure, sustained maximal inspiratory pressure, inspiratory duration, the Test of Incremental Respiratory Endurance
            2. Breath-by-breath gas analyses
    c. Clinical strategies for implementation
        i. How the use of respiratory factors might improve diagnosis, prognosis, and treatment of LBP
3) Cardiovascular Function and LBP (25 min) - Cahalin
    a. Overview of the relationship between cardiovascular function and LBP
        i. Muscle Hypothesis of Heart Failure and LBP

The Muscle Hypothesis of Chronic Heart Failure & Low Back Pain



ii. Heart rate recovery and pain mechanisms in LBP
b. Tools and methods for measuring cardiovascular and respiratory muscle function
i. Heart rate and heart rate recovery
ii. Blood pressure
iii. Maximal inspiratory and expiratory pressure and respiratory endurance
c. Clinical strategies for implementation

4) Autonomic Nervous System Function and LBP (25 min) - Sueki
a. ANS Activity as a Biomarker for Pain
i. The link between pain and autonomic responses
ii. ANS activity is measured indirectly through activity of the systems it controls such as heart rate variability
b. Physiology of Heart Rate Variability
i. What is heart rate variability?
1. The body and brain are constant monitoring its environment for threat and changes in environment. Heart rate adapts to this constantly changing conditions (no two beats are the same)
ii. How is heart rate variability regulated?
1. Heart rate is regulated by the coordinated activity of the sympathetic and parasympathetic nervous system
a. Parasympathetic responses occur first - Decreased activity
b. Sympathetic responses follow - Increased activity
c. Heart rate variability assessment
i. Time Domain - Changes in beat frequency (RR interval)
ii. Frequency
1. Very Low (VLF) and Low Frequency (LF) – Sympathetic
2. High Frequency (HF) – Parasympathetic
3. LF/HF Ratio - Balance between the two
d. Summary of HRV
i. Heart rate variability testing allows for researchers and clinicians to indirectly measure body and brain protective responses to threat and the environment
e. Research
i. HRV and Chronic Pain in Literature
1. Pneumogastric (Vagus) Nerve Activity Indexed by HRV in Chronic Pain Patients Compared to Healthy Controls: A Systematic Review and Meta-Analysis. Koenig et al 2016.
2. HRV in patients with fibromyalgia and patients with chronic fatigue syndrome: A systematic review. Meesus et al 2013.
3. Meta-analytic evidence for decreased HRV in chronic pain implicating parasympathetic nervous system dysregulation. Tracy et al 2016.
ii. HRV as a Biomarker for Pain
1. HRV as a biomarker of fibromyalgia syndrome. Staud 2008.

2. HRV as a biomarker for autonomic nervous system response differences between children with chronic pain and healthy control children. Evans et al 2013.
3. Nocturnal HRV parameters as potential fibromyalgia biomarker: correlation with symptoms severity. Lema et al 2011.
4. Autonomic regulation, physical activity and perceived stress in subjects with musculoskeletal pain: 24-hour ambulatory monitoring. Hallman 2012.

iii. HRV and Low Back Pain
1. No known research, but extrapolations from parallel lines of research in chronic pain can be made.

iv. Conclusions
1. Chronic pain appears to impact vagal responses

f. Clinical Application
i. The importance of vagal (parasympathetic) responses
ii. Interventional studies focus on decreasing sympathetic drive or increasing parasympathetic (vagal) responses)
1. HRV and yoga
2. HRV and spinal manipulation and manual therapy
3. HRV and acupuncture
4. HRV and hydrotherapy
5. HRV and mindfulness meditation
6. HRV and biofeedback
7. HRV and exercise

iii. How can HRV be measured in clinic?
1. Phone apps that measure HRV

g. Summary and Conclusions

5) Pain Processing and LBP (25 min) –Bialosky
a. Augmented pain processing in clinical conditions
i. Centralized pain conditions
1. Fibromyalgia as the classic example
2. “Fibromyalgianess”
3. Low back pain as a centralized pain condition

ii. Individual variability in pain processing

b. Quantitative sensory testing
i. Defined
ii. Static measures
1. Threshold
2. Tolerance

iii. Dynamic measures
1. Temporal summation
2. Conditioned pain modulation

iv. Quantitative sensory testing fallacies
1. Does not equal “central sensitization”
2. Are not patient centered outcomes

c. Pain modulatory phenotypes

i. “Pro- nociceptive”
ii. “Anti- nociceptive”

d. Quantitative sensory testing as a biomarker for low back pain
i. Diagnostic utility
ii. Prognostic utility
iii. Direct mechanistic based treatment approaches
1. Treatment moderator
2. Treatment mediator

6) Questions and Answers (15 min)

SPEAKER INFORMATION

Marlon L. Wong, PT, DPT, PhD
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BIOGRAPHIES

Marlon L. Wong, PT, DPT, PhD
Board Certified Orthopaedic Specialist

Marlon Wong received his Master of Science in Physical Therapy from Florida International University in 2002. He then went on to complete his transitional DPT and residency training through the Ola Grimsby Institute, followed by completion of a PhD in Physical Therapy from Nova Southeastern University. Dr. Wong is currently faculty in the Department of Physical Therapy at the University of Miami, serving as Director of the UMPT Orthopaedic Residency Program. Additionally, he lectures in the UM entry level DPT program on spine, clinical reasoning, and pain science related topics. Dr. Wong's current research focus is on autonomic and breathing pattern changes associated with chronic pain and the responses of these factors to intervention.

Lawrence P. Cahalin PhD, PT, CCS

Lawrence P. Cahalin PhD, PT, CCS is a full Professor in the Department of Physical Therapy at the University of Miami in Miami, Florida. He received his BS in Physical Therapy at Saint Louis University, a MA in Physical Therapy at the University of Iowa, and a PhD in Gerontology at the University of Massachusetts Boston. Throughout his career he has consistently been recruited to give lectures on a variety of topics pertaining to cardiovascular and pulmonary examination and management. He enjoys integrating the interrelatedness of the cardiovascular, pulmonary, and muscular systems using novel examination and management techniques. He has given 270 presentations on a variety of topics both nationally (N=190) and internationally (N=80) with the majority of presentations being invited lectures. He is an avid researcher and has published over 100 peer-reviewed manuscripts and 21 non-peer reviewed manuscripts. He has also co-edited two editions of a textbook on cardiovascular and pulmonary physical therapy in which he has authored or co-authored 8 of 22 chapters in the first edition of the textbook and 9 of 23 chapters in the second edition of the textbook. Dr. Cahalin has been actively involved in clinical research and clinical practice in cardiovascular and pulmonary physical therapy for over 35 years and was part of the initial 5-member panel of physical therapists who developed the APTA Preferred Practice Patterns in Cardiovascular and Pulmonary Physical Therapy. He is an APTA Board Certified Cardiovascular and Pulmonary Specialist and currently serves on the Editorial Board of both the APTA Cardiopulmonary Physical Therapy Journal and Physiotherapy Theory and Practice - An International Journal of Physical Therapy. Dr. Cahalin is a fellow of the American Heart Association and American Association of Cardiovascular and Pulmonary Rehabilitation.

Derrick Sueki, PT, DPT, PhD, GCPT
Board Certified Orthopaedic Specialist
Fellow in the American Academy of Orthopaedic and Manual Physical Therapists

Derrick Sueki graduated from the University of Southern California receiving his Doctorate in Physical Therapy and has successfully defended his PhD at Nova Southeastern University. He completed the Post Graduate Certificate Program in Physical Therapy at the University of South

Australia with a special emphasis in Manipulative Therapy and Central Pain Mechanisms. He is an Assistant Professor in the Department of Physical Therapy at Azusa Pacific University and adjunct faculty at Mount Saint Mary's University. Additionally, he is President of Knight Physical Therapy, an outpatient orthopedic clinic located in Garden Grove, California and Azusa Physical Therapy Associates located in Azusa, California. Dr. Sueki is a chief editor of two orthopedic textbooks, *Orthopedic Rehabilitation Clinical Advi*sor and the *Orthopedic Physical Assessment Atlas and Video*. Dr. Sueki has served as chair of the Orthopedic Specialty Council for the Orthopedic Specialty Examination, serves on the Research Council for the California Section of the APTA, and is on the work group tasked with developing a clinical practice guideline for pain education. He currently has several lines of active research focusing on the neurophysiological mechanisms underlying pain memory, associative learning, and the behavioral responses associated with injury.

Joel E. Bialosky, PT, PhD
Board Certified Orthopaedic Specialist
Fellow in the American Academy of Orthopaedic and Manual Physical Therapists

Joel Bialosky, PT, PhD, FAAOMPT, OCS is a Clinical Assistant Professor in the Department of Physical Therapy at the University of Florida in Gainesville, Florida. Dr. Bialosky worked for over 14 years clinically primarily in orthopedic and musculoskeletal physical therapy settings before leaving clinical practice to pursue his PhD and a career in academia. He is a board certified clinical specialist in Orthopedics and a fellow in the American Academy of Orthopedic Manual Physical Therapists. He received a bachelor's degree in physical therapy from Ithaca College in 1990 and a master's degree in musculoskeletal physical therapy from the University of Pittsburgh in 1998. He graduated from the University of Florida with a PhD in Rehabilitation Science in 2008 with his research interests focused on the mechanisms of manual therapy in the treatment of musculoskeletal pain. His current research program is focused on 1.) placebo mechanisms of manual therapy and 2.) neuroplastic changes in pain associated with musculoskeletal disorders and their response to common rehabilitation interventions.

KEYWORDS

Low back pain, breathing, heart rate recovery, heart rate variability, quantitative sensory testing, pain processing

TEACHING STRATEGIES AND INSTRUCTIONAL LEVELS

Teaching Strategies

Didactic lecture mixed with clinical application

Use of technology, in the form of photos and videos, where appropriate

INSTRUCTIONAL LEVEL

Intermediate

CONFLICT OF INTEREST DISCLOSURE

The authors of this proposal have no conflicts of interest to disclose