A Functional Understanding of Pain Science, Movement, and Manual Therapy

(HRF-FUPSMMT)

2021 Course Manual

Presented by Leonard Van Gelder DPT, ATC, TPS, CSMT, CSCS

This course manual includes slides from the course lecture as well as references to the journal articles and other valuable resources. Please note, this manual will not contain all the slides from the lecture, nor will it provide all the references discussed in the course. Due to the "dynamic" nature of the course, content may change up until the start of the class. Furthermore, due to the amount of content covered in the lecture, some deliberate effort was made to reduce the scale of the print manual. It is the responsibility of the attendee to request content or references provided in the course that is not provided within the manual. In addition, due to certain copyright and proprietary agreements, not all content can be provided to attendees.

Course Background

Research on the science of pain spanning the past three decades has changed the way we understand, educate, and treat pain. This educational evolution is built on a biopsychosocial framework and its application has resulted in improvements of clinical outcomes including: decreased pain, reduction in fear of movement, promotion of better quality movement, increased motivation and willingness of patients to participate in exercise and skilled therapy, and decreased overutilization of medical services. Furthermore, these improvements have been shown to be greater when combined with movement and manual therapy. Concurrent to these developments in pain science, movement science has increasingly recognized the interplay of biopsychosocial factors in human movement. Advancements in research on biomechanics, motor control, and manual therapy have also revealed an increased need for clinicians to recognize and understand the complex layers of the lived human experience as playing important roles in assessment and prescription of movement.

Course Description

This course provides a broad overview and practical application of contemporary pain science, movement science, manual therapy, communication, and behavior change utilizing a biopsychosocial process-based framework called the Human Rehabilitation Framework (HRF). The HRF is presented as transdiagnostic alternative to diagnosis classification and protocol for movement and rehabilitation specialists. This course work is a blend of lecture, lab, and case studies to maximize clinical application.

Course Objectives

1. To provide an overview of current science-based knowledge related to pain science, movement and manual therapy.
2. Discuss why understanding that nociception does not guarantee pain is important for both clinicians, and our patients, to understand and treat pain.
3. Describe why understanding nociception, in the absence of pain, is important to understanding mobility and movement.
4. Compare and contrast a biopsychosocial process-based approach to diagnostic classification and protocols.
5. Introduce the Human Rehabilitation Framework (HRF) as a biopsychosocial process-based treatment approach for movement and pain.
6. Describe how a biopsychosocial informed approach to movement and manual therapy can be integrated into existing practice.
7. Summarize two changes you can make in your current practice related to therapy to more effectively educate patients on pain and mobility, while simultaneously increasing self-efficacy and reducing dependency on passive interventions.

Course Educator Biography

Leonard Van Gelder is a physical therapist, athletic trainer, therapeutic pain specialist, spinal manual therapist, and strength and conditioning specialist. He has been involved in the movement and rehabilitation field for over 15 years. He has studied, published research, and presented at regional and international conferences on the science of stretching, strength and conditioning, and therapeutic pain science interventions. He owns and practices clinically at Dynamic Movement and Recovery (DMR) in Grand Rapids, MI.

A FUNCTIONAL UNDERSTANDING OF PAIN SCIENCE, MOVEMENT, AND MANUAL THERAPY

DYNAMIC PRINCIPLES

Leonard Van Gelder DPT, ATC, TPS, CSMT, CSCS

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Disclosure / Conflict of Interest

Financial - I own an educational company (Dynamic Principles, LLC.) and I receive a fees for teaching about pain science, movement, and manual therapy.

Nonfinancial— I am involved in research related to pain science, movement, and manual therapy

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Introductions

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Course Objectives

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4

SCIENCE

5

SWEARING – GOOD FOR PAIN

Stephens, Richard, and Claudia Umland. "Swearing as a response to pain—Effect of daily swearing frequency." *The Journal of Pain* 12.12 (2011): 1274-1281.

Stephens, Richard, John Atkins, and Andrew Kingston. "Swearing as a response to pain." *Neuroreport* 20.12 (2009): 1056-1060.

Philipp, Michael C., and Laura Lombardo. "Hurt feelings and four letter words: Swearing alleviates the pain of social distress." European Journal of Social Psychology 47.4 (2017): 517-523.

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CAFFEINE IS YOUR FRIEND

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8

CURRENT THERAPY CONTEXT

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HEALTHCARE CULTURE

DYNAMIC PRINCIPLES

- Which of these proposed mechanisms for improving dorsiflexion of an ankle makes the most sense to you?
- Which of these two mechanisms have scientific evidence to support for their proposed mechanisms?

Using Cyriax's principles of cross friction massage, IASTM improves dorsiflexion via breaking down collagen adhesions in the achilles tendon and gastrocsoleus complex resulting in improved flexibility of the ankle.

Therapeutic staging of the environment and therapeutic alliance with the clinician presents the patient with a sense of comfort and recognition that this is a place of healing priming the patient's nervous system for an improved outcome. The clinician's interaction with the skin overlying the calf and achilles results both in somatosensory cortex reorganization, as measured by improvements in tactile acuity, and somatic and autonomic modulation in the region. Modulation of the region results in improvement of ankle dorsiflexion stretch tolerance via multisystem interactions for both acute and long standing ankle dorsiflexion improvements.

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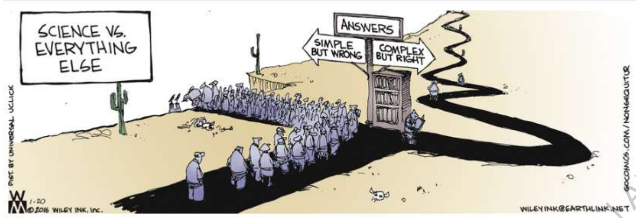

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Sleeping giants

- "I am convinced that physiotherapy and occupational therapy are sleeping giants."
- "Traditional apprenticeship are taught by a senior physiotherapist who looked back with cozy pride to the traditional art. Bright younger physiotherapists and occupational therapists began to seek education to learn the rationale for what they were doing."
- "But what education? The answer seemed to be obvious: ***an abbreviated and dumbed-down version of what medical students were taught***. This was a particularly unfortunate approach to the crucial subject of pain" – Patrick Wall, MD

AND ATHLETIC TRAINERS!

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"Our best approach to describing the universe is not a single, unified story but an interconnected series of models appropriate at different levels. Each model has a domain in which it is applicable." – Sean Carroll

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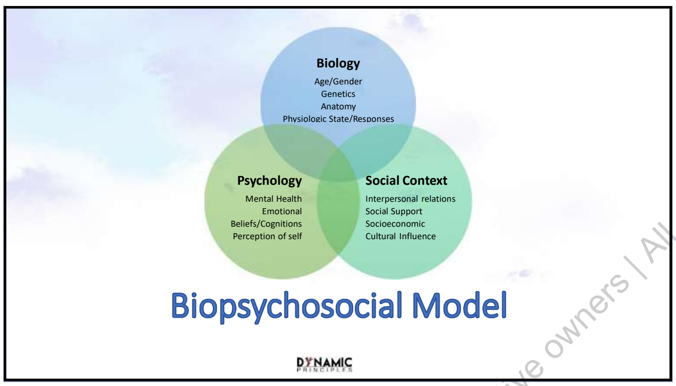

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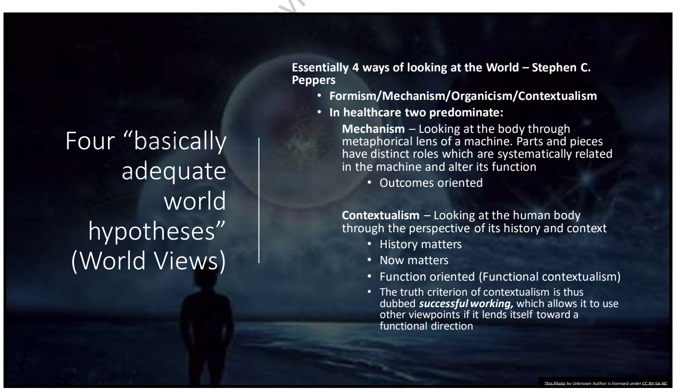

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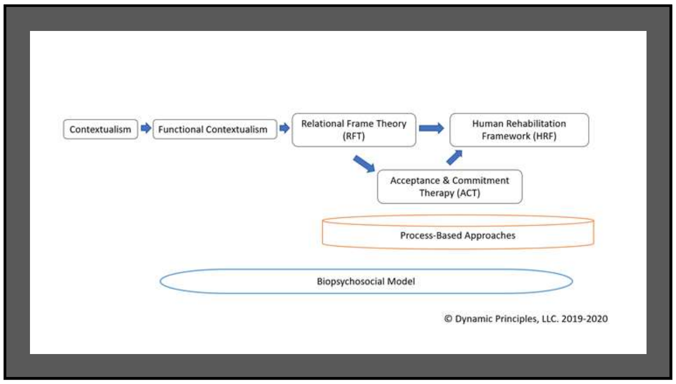
Contextualism
Functional Contextualism
Relational Frame Theory (RFT)
Human Rehabilitation Framework (HRF)
Acceptance & Commitment Therapy (ACT)
Process-Based Approaches
Biopsychosocial Model
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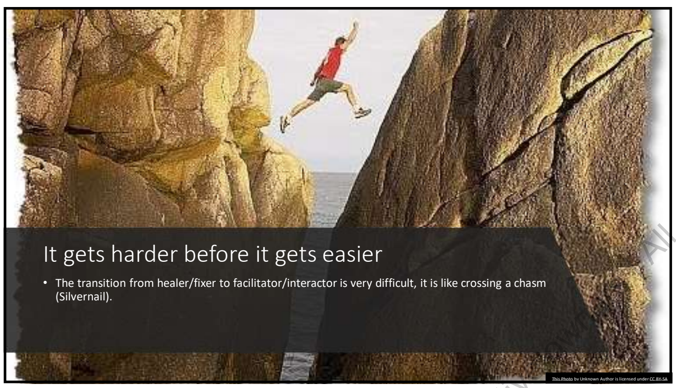
It gets harder before it gets easier
• The transition from healer/fixer to facilitator/interactor is very difficult, it is like crossing a chasm (Silvernail).

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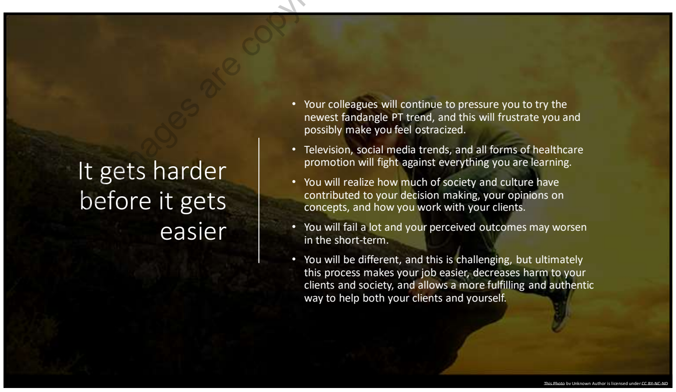
It gets harder before it gets easier
• Your colleagues will continue to pressure you to try the newest fandangle PT trend, and this will frustrate you and possibly make you feel ostracized.
• Television, social media trends, and all forms of healthcare promotion will fight against everything you are learning.
• You will realize how much of society and culture have contributed to your decision making, your opinions on concepts, and how you work with your clients.
• You will fail a lot and your perceived outcomes may worsen in the short-term.
• You will be different, and this is challenging, but ultimately this process makes your job easier, decreases harm to your clients and society, and allows a more fulfilling and authentic way to help both your clients and yourself.

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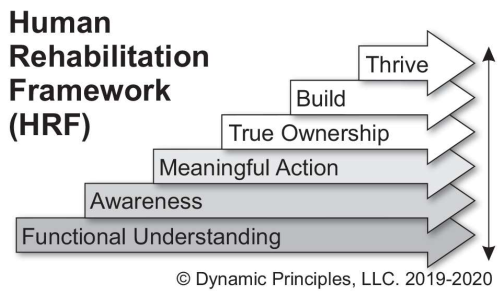

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Functional Understanding

- Functional understanding from the clinician is primary and oriented to support diverse biopsychosocial processes.
- Function understanding for the patient must be contextual and functional.
- Functional understanding is primarily for supporting behavior change and processing, symptom change is not primary but may occur concurrently.
- Functional understanding is an ongoing process; it does not end.

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Initial Functional Understanding Aims

1. Do we have a pain problem?
2. What is pain?
3. Is pain caused by tissue damage?
4. What is the modern scientific understanding of pain?
5. Do we have a problem with our language?
6. How can we help people struggling with pain?

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Do we have a pain problem?

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A STRUGGLING SYSTEM

- Despite advances in diagnostics, surgery, regenerative medicine, pharmacology, and rehabilitative interventions; chronic pain continues to grow in prevalence.
- Chronic pain is more prevalent than heart disease, diabetes, and cancer combined. (Institute of Medicine 2012: Relieving Pain in America)

"If we are so good [at treating pain], then why are our patients so bad?"
-Patrick Wall

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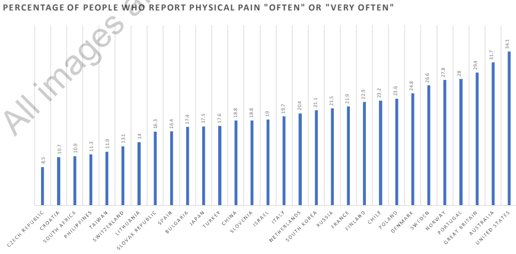
During the past four weeks, how often have you had bodily aches or pains?
Never; seldom; sometimes; often; or very often?

PERCENTAGE OF PEOPLE WHO REPORT PHYSICAL PAIN "OFTEN" OR "VERY OFTEN"



Unhappiness and Pain in Modern America - *Blanchflower & Oswald*

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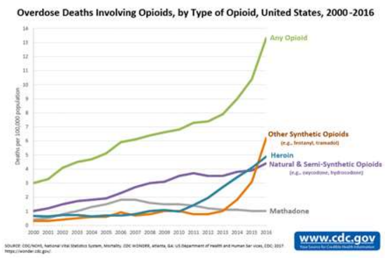
Opioid/Heroin Epidemic



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What is pain?

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Meet John

- John Smith
- 34 years old
- Self-Employed Information Technology Consultant
- Married – Wife is stay at home mom
- 2 Kids - Daughter and son under 10 years of age
- Active life
- Enjoys strength training and running

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The Event
• Picked up a paper plate on the ground at a family gathering
• Heard a pop
• Immediate severe back pain
• 2 hours later left leg pain
DYNAMIC PRINCIPLES

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DYNAMIC PRINCIPLES
Why did John's back and leg hurt?

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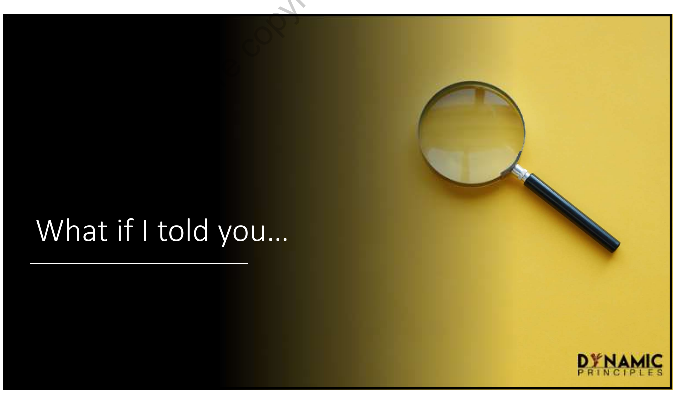
What if I told you…
DYNAMIC PRINCIPLES

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There are NO *Pain Sensors* or *Pain Signals* in the human body!

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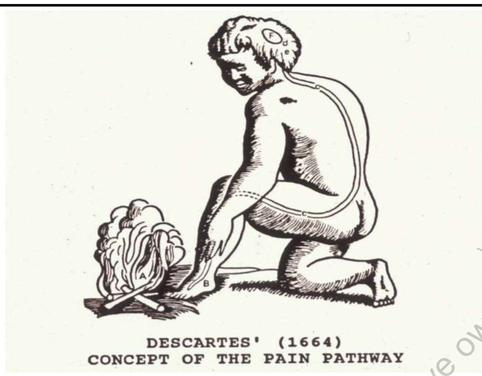

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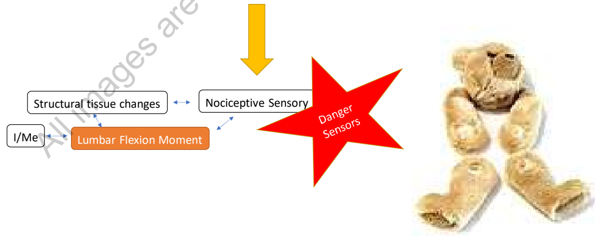
DYNAMIC PRINCIPLES



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Building John's Bear

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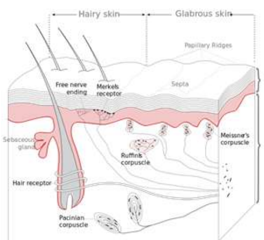

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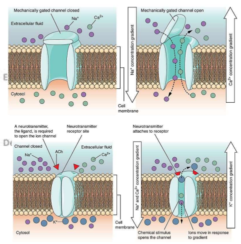

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DYNAMIC PRINCIPLES

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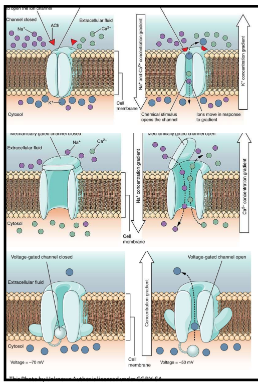

ION CHANNELS (SENSORS)

- Mechanical (touch/movement)
- Immune
- Blood flow
- Thermal (even weather)
- Stress Chemistry (adrenalin/cortisol)

DYNAMIC PRINCIPLES

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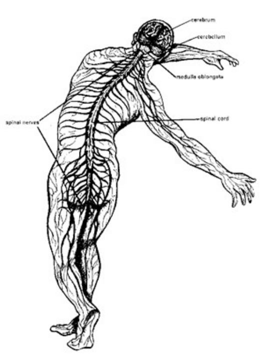
- 45 miles
- 400 unique nerves

DYNAMIC PRINCIPLES



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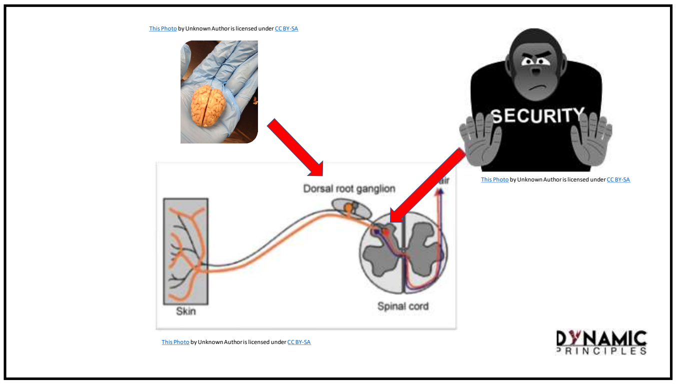
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SECURITY
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Dorsal root ganglion
Skin
Spinal cord
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DYNAMIC PRINCIPLES

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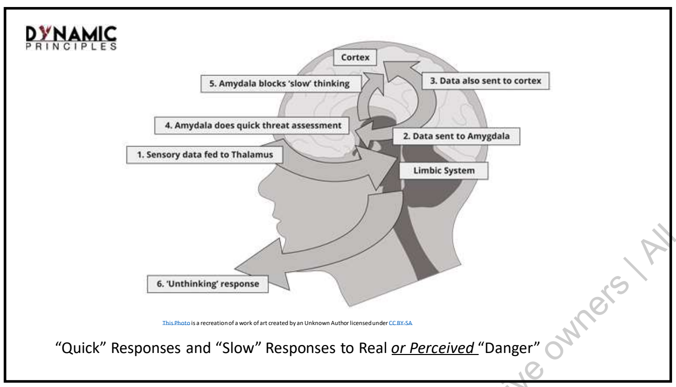
DYNAMIC PRINCIPLES
Cortex
5. Amydala blocks 'slow' thinking
3. Data also sent to cortex
4. Amydala does quick threat assessment
2. Data sent to Amygdala
1. Sensory data fed to Thalamus
Limbic System
6. 'Unthinking' response
This Photo is a recreation of a work of art created by an Unknown Author licensed under CC BY-SA
"Quick" Responses and "Slow" Responses to Real *or Perceived* "Danger"

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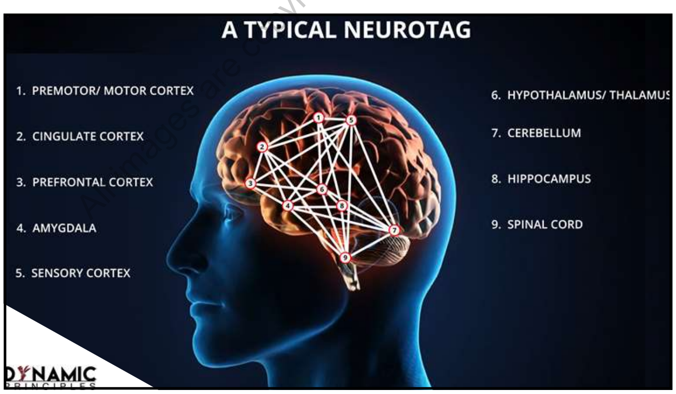
A TYPICAL NEUROTAG
1. PREMOTOR/ MOTOR CORTEX
2. CINGULATE CORTEX
3. PREFRONTAL CORTEX
4. AMYGDALA
5. SENSORY CORTEX
6. HYPOTHALAMUS/ THALAMUS
7. CEREBELLUM
8. HIPPOCAMPUS
9. SPINAL CORD
DYNAMIC PRINCIPLES

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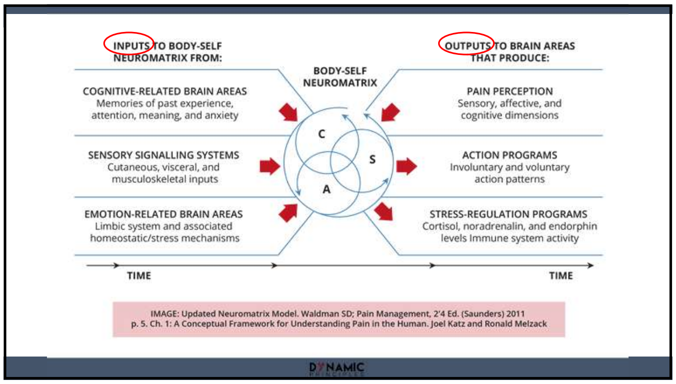
INPUTS TO BODY-SELF NEUROMATRIX FROM:
BODY-SELF NEUROMATRIX
OUTPUTS TO BRAIN AREAS THAT PRODUCE:
COGNITIVE-RELATED BRAIN AREAS
Memories of past experience, attention, meaning, and anxiety
SENSORY SIGNALLING SYSTEMS
Cutaneous, visceral, and musculoskeletal inputs
EMOTION-RELATED BRAIN AREAS
Limbic system and associated homeostatic/stress mechanisms
C
S
A
PAIN PERCEPTION
Sensory, affective, and cognitive dimensions
ACTION PROGRAMS
Involuntary and voluntary action patterns
STRESS-REGULATION PROGRAMS
Cortisol, noradrenalin, and endorphin levels Immune system activity
TIME
TIME
IMAGE: Updated Neuromatrix Model. Waldman SD; Pain Management, 2'4 Ed. (Saunders) 2011
p. 5. Ch. 1: A Conceptual Framework for Understanding Pain in the Human. Joel Katz and Ronald Melzack

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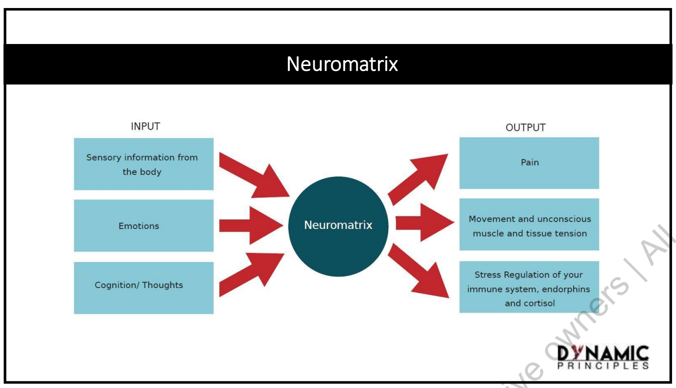
Neuromatrix
INPUT
Sensory information from the body
Emotions
Cognition/ Thoughts
Neuromatrix
OUTPUT
Pain
Movement and unconscious muscle and tissue tension
Stress Regulation of your immune system, endorphins and cortisol

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OWW!

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DEFINITION OF PAIN

An unpleasant sensory and emotional experience associated with, or resembling that associated with, ***actual or potential*** tissue damage.

Updated 7/16/2020

International Association for the Study of Pain

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2020 UPDATE NOTES RELATED TO DEFINITION OF PAIN

- Pain is always a personal experience that is influenced to varying degrees by biological, psychological, and social factors.
- Pain and nociception are different phenomena. Pain cannot be inferred solely from activity in sensory neurons.
- Through their life experiences, individuals learn the concept of pain.
- A person's report of an experience as pain should be respected.
- Although pain usually serves an adaptive role, it may have adverse effects on function and social and psychological well-being.

Updated 7/16/2020

International Association for the Study of Pain

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PAIN DEFINITIONS

Nociceptive

Pain that arises from actual or threatened damage to non-neural tissue and is due to the activation of nociceptors.

Classically mechanical/chemical associated pain experience

Neuropathic

Pain caused by a lesion or disease of the somatosensory nervous system.

Classically nerve tissue injury identifiable with diagnostic testing

Nociplastic – ***IASP Official as of February 5th, 2018!***

Pain that arises from altered nociception despite no clear evidence of actual or threatened tissue damage causing the activation of peripheral nociceptors or evidence for disease or lesion of the somatosensory system causing the pain.

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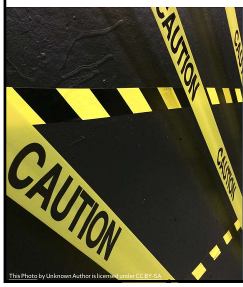
NOCICEPTION DEFINITION

DYNAMIC PRINCIPLES



- The neural process of encoding noxious stimuli.
- *Note:* Consequences of encoding may be autonomic (e. g. elevated blood pressure) or behavioral (motor withdrawal reflex or more complex nocifensive behavior). Pain sensation is not necessarily implied.
- Nociception has extremely important physiologic importance, in particular in movement and manual therapy.
- ROM / Flexibility is determined by alterations in nociceptive pathways!

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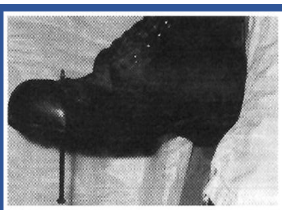
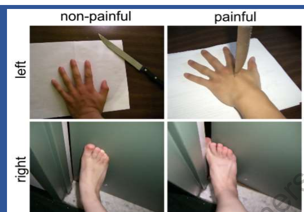
IS NOCICEPTION NECESSARY?

DYNAMIC PRINCIPLES



Fisher et al.



Osborn et al.

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Nociception is neither sufficient, nor necessary for pain.

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DAMAGE AND PAIN??

- Damage does not equal pain and pain can occur without damage
- Nearly 30% of people, not in shock/fully coherent, who present to the ER with gross deformities from trauma (fractures, amputation of fingers, stabs, and crushes) experience ***no pain***, only embarrassment long after the injury.
  - Mr. Hammerhead and his knee – *Painful Yarns*
- 43% of amputees experience some degree of limb pain long after the original injury (Desmond and Maclachlan)

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"I said it probably 15 times, 'Coach, I'm going to be good, you just got to win this game,'" he told ESPN's Rece Davis today in his first interview since the injury.

"It was one of those things where I couldn't believe it. I honestly didn't feel the pain. It was more a shock," Ware said.

Ware said he didn't realize at first what had happened until he saw his coach Rick Pitino's face as he ran out on the court to help him.

"He went to help me up, he glanced at my leg and his eyes got huge," Ware said. "I looked down at my leg and it was just automatic shock."

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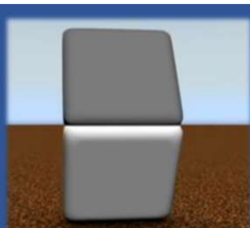

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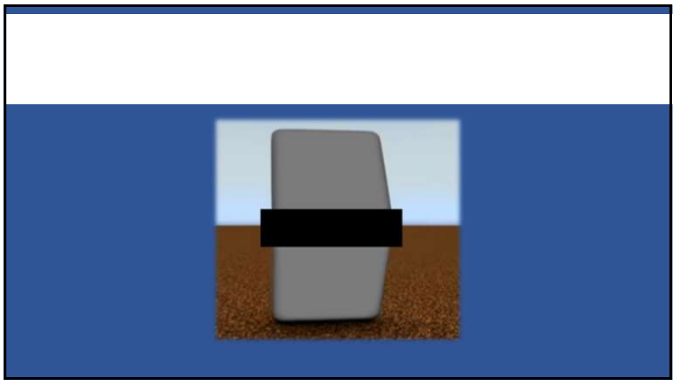

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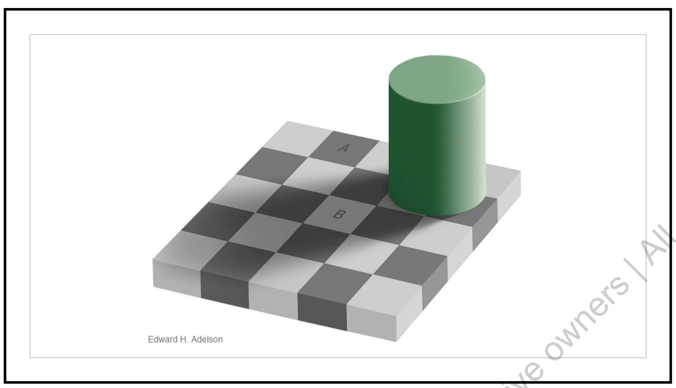

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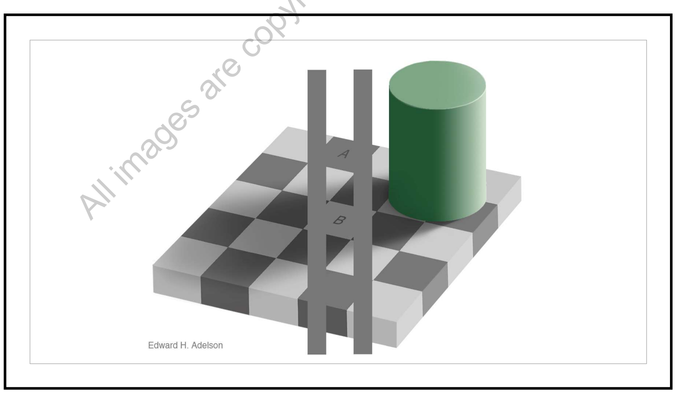

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PAIN IS A COMPLEX INDIVIDUAL EXPERIENCE– JUST LIKE VISION

- Just like vision you can't convince yourself to experience anything other than the sum of the processes your brain has concluded
- The brain ALWAYS makes assumptions with vision!
  - *Thankfully it's mostly right or we'd be hitting doorways all the time.*
- Pain may make a correct assumption about danger but does not guarantee danger, it is also more readily confused than vision (more processing involved!)
- Pain education and interventions is NOT about ignoring pain, it is about functionally working with the experience!
- **YOU CAN'T OUTTHINK PAIN!**

DYNAMIC PRINCIPLES

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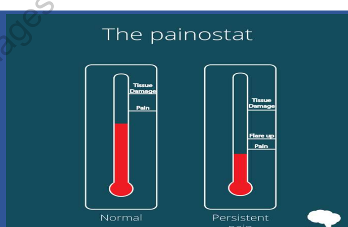
PAIN IS ALWAYS AN INTENSE AS IT NEEDS TO BE!
IT WILL ALWAYS BE THE WORST PAIN POSSIBLE IF IT WANTS YOUR ATTENTION!

DYNAMIC PRINCIPLES



A patient report of 15/10 pain is a 15/10 regardless of their affect or behavior! STOP JUDGING!

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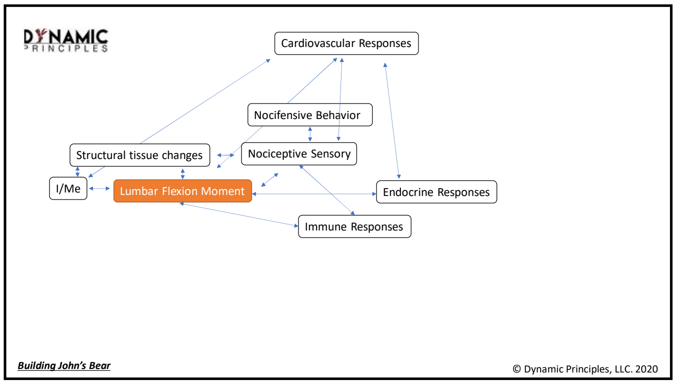

DYNAMIC PRINCIPLES
Cardiovascular Responses
Nocifensive Behavior
Structural tissue changes
Nociceptive Sensory
I/Me
Lumbar Flexion Moment
Endocrine Responses
Immune Responses
Building John's Bear
© Dynamic Principles, LLC. 2020

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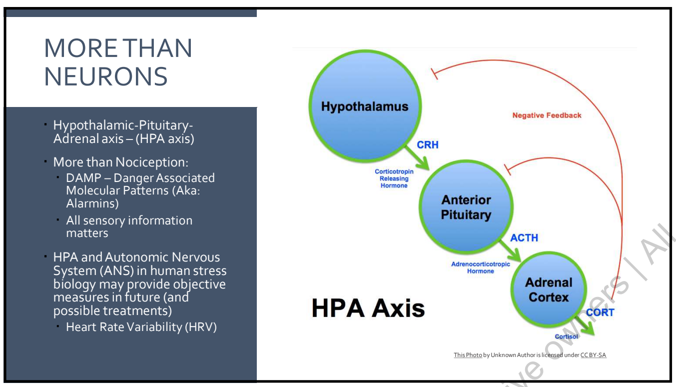

MORE THAN NEURONS
Hypothalamic-Pituitary-Adrenal axis – (HPA axis)
More than Nociception:
DAMP – Danger Associated Molecular Patterns (Aka: Alarmins)
All sensory information matters
HPA and Autonomic Nervous System (ANS) in human stress biology may provide objective measures in future (and possible treatments)
Heart Rate Variability (HRV)
Hypothalamus
CRH
Corticotropin Releasing Hormone
Negative Feedback
Anterior Pituitary
ACTH
Adrenocorticotropic Hormone
Adrenal Cortex
CORT
Cortisol
HPA Axis

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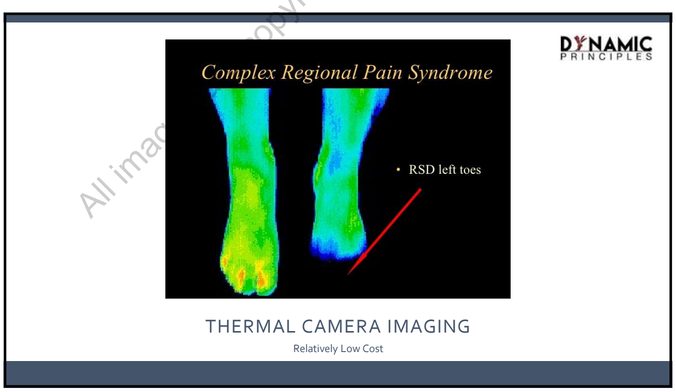

DYNAMIC PRINCIPLES
Complex Regional Pain Syndrome
RSD left toes
THERMAL CAMERA IMAGING
Relatively Low Cost

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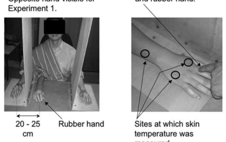
DYNAMIC PRINCIPLES

VASOMOTOR CHANGES ARE NORMAL NOT JUST CRPS!



PNAS | September 2, 2008 | vol. 105 | no. 35 | 13173

Psychologically induced cooling of a specific body part caused by the illusory ownership of an artificial counterpart

Moseley, G. Lorimer, et al. "Psychologically induced cooling of a specific body part caused by the illusory ownership of an artificial counterpart." *Proceedings of the National Academy of Sciences* 105.35 (2008): 13169-13173

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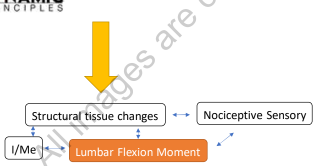
DYNAMIC PRINCIPLES



63

What might have happened in John's spine?

64

Disc Herniation Basics

Disc Herniation Basics

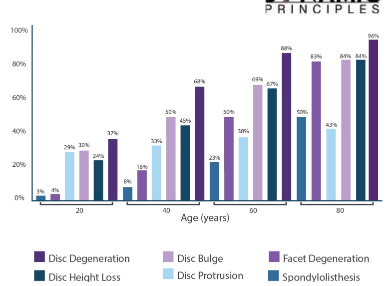
65

SPINE

Brief Imaging review

"Even when applying more specific definitions for spine-related symptom outcomes, few MRI findings showed large magnitude associations with symptom outcomes"- Suri, et. al 2013)

- ***Facet Arthritis with ACTIVE inflammation on imaging is NOT associated with pain – It shows up randomly on imaging!***



Brinjikji, et al. 2014

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SPINE UPDATE

PLOS One November 2017 – 10 year longitudinal analysis

- When tracking MRI findings for individuals over 10 years
  - Pfirrmann grading ≥4,
  - Disc bulging and associated changes
  - High Intensity Zones
  - Spondylolisthesis
  - Any type of Modic changes
- NONE were associated with LBP history during the 10 years between the baseline and follow-up study.
- The progresses of these findings were also not associated with the LBP history.
- Baseline MRI findings were not associated with LBP history during the 10 years

"our data suggest that baseline MRI findings cannot predict future LBP."

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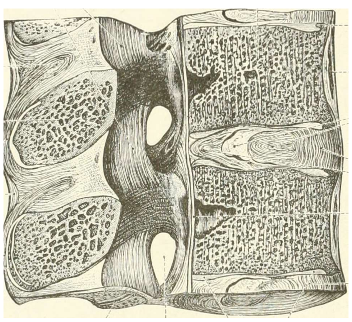

PSA: DISCS CANNOT "SLIP" OR "GO OUT OF ALIGNMENT"!

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SPINAL DISC HERNIATION MADE SIMPLE PART 1

- All acute disc herniations are secondary to end plate fracture or progressive failure – "Modic Changes" – Curry et al.
- This is typically the "pop" reported in acute incidents
- May happen subtly with age without noise or us ever knowing it happened

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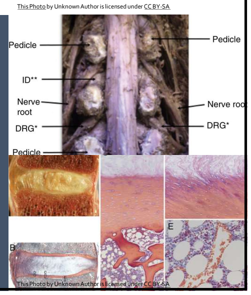
SPINAL DISC HERNIATION MADE SIMPLE PART 2

- Nerves become chemically sensitized which makes them mechanically sensitive
  - Chemo sensitivity also means sensitivity to blood flow variation – which is another reason why sitting and stationary positions sucks – Blood/Movement/Space!
- ***Improvement in symptoms from extension HAS VERY LITTLE (if anything!) to do with the disc->***



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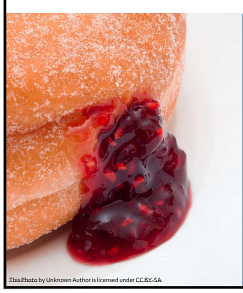
IT'S NOT A JELLY DONUT!



Direction of nucleus migration is unpredictable (Broetz et al.)
- Just as likely to migrate posteriorly with extension and neutral

Dynamic MRIs for disc degeneration trend toward extension creating posterior migration – See Jinkins in next slide

Extension exercise does not influence on disc fluid content or distribution (Abdollah V, et al. – November 2017)
- The "Disc Pump" theory therefore would not work
- Movement seems to be helpful, and in some cases extension feels better than flexion but it is ***NOT*** related to intervertebral disc mechanics.

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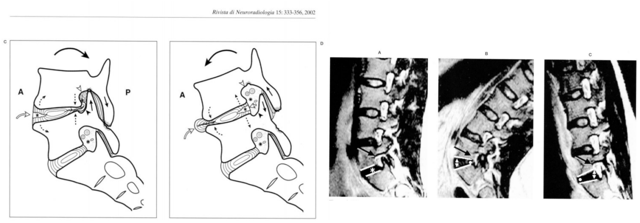

Jinkins, J. RANDY, et al. "Upright, Weight-Bearing, Dynamic-Kinetic MRI of the Spine p MRI/k MRI." *Rivista di Neuroradiologia* 15.4 (2002): 333-357.

DYNAMIC PRINCIPLES

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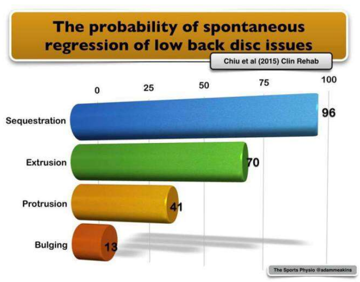
SPONTANEOUS RESORPTION OF THE DISC IS HIGH



66.66% of spinal discs spontaneous re-absorb ***without any intervention!*** – Zhong et al.

Bigger is better!

DYNAMIC PRINCIPLES

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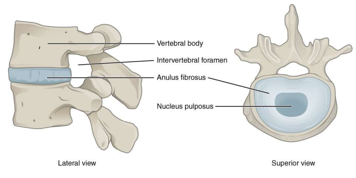
STRESSING THE DISC

Biomechanical Stress
- The spinal disc annulus runs parallel which requires flexion and rotation in order to stress – might need this to improve! – Not been tested yet!
- Disc density improves with
  - Running - Belavy, et al.
  - High intensity exercise – Bowden et al.
  - Likely any progressive well planned stress!



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THE DISC AND THE NERVE ROOT - 1

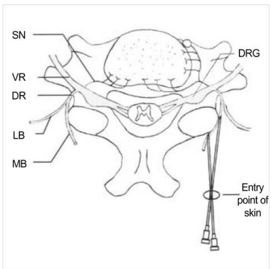

Image from Shin, Woo-Ram, et al. "Radiofrequency neurotomy of cervical medial branches for chronic cervicobrachialgia." *Journal of Korean medical science* 21.1 (2006): 119-125.

Generally, the spinal disc is irrelevant to symptoms
- Symptoms occur if
  - The sinuvertebral nerve (SN) is sensitized – potential contribution to experience of neck/thoracic/low back pain
  - The medial branch (MB) of the dorsal rami is sensitized - potential contribution to experience of neck/thoracic/low back pain
    - Probably other branches of dorsal rami could be sensitized just not well studied!
  - The nerve root is sensitized – potential contribution to experience of leg/arm/head/trunk and neck/thoracic/low back pain

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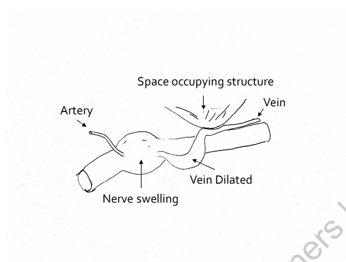
THE DISC AND THE NERVE ROOT - 2

- The spinal disc only matters if
  - There are cord signs, cauda equina, or profound neurologic impairment to the involved root
  - The nerve root can't breath for extended periods of time
    - Tourniquet effect
      - Inadequate exchange of blood flow through the nerve due to sustain pressure resulted in poor venous distribution, dilation of veins, swelling of the nerve which can have provide mechanical and chemical sensitization



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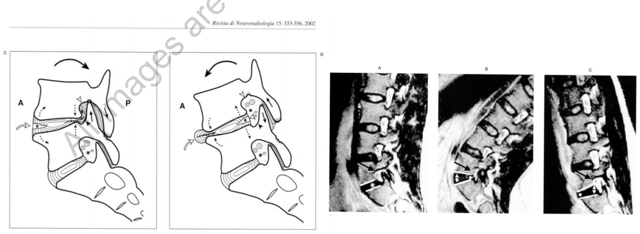

Jinkins, J. RANDY, et al. "Upright, Weight-Bearing, Dynamic-Kinetic MRI of the Spine p MRI/k MRI." *Rivista di Neuroradiologia* 15.4 (2002): 333-357.

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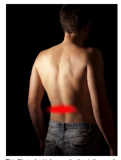
DIRECTIONAL PREFERENCE

- Nothing wrong with the term IF the health of the nerve root is kept at the FOREFRONT
- Caution with peripheralization vs. centralization
  - Understanding that the brain decides whether we experience pain or not, and WHERE we feel it is is vital here
  - Leg pain can centralize with increased back pain experience in extension due to DNIC (Diffuse Noxious Inhibitory Control)
    - IE: the back hurts so bad, I don't feel the leg pain anymore
  - This could mean worsening tourniquet effect of the nerve root which could cause nerve injury
    - Documented cases of nerve injury in students attending early McKenzie courses in England with demonstration of sustained overpressure!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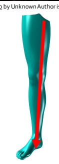
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DIRECTIONAL PREFERENCE

- Integrate the nerve root and focus on:
  - GREEN LIGHT GREEN LIGHT
    - Decrease leg and decrease back
- The inability to extend or flex will generally self correct as you treat the pain – Same with the 'dreaded' lateral shift
  - Remember – structure isn't changing with what you do, it's just protective behavior!
  - If movement behavior still is protective, you can guide them out of it over time, no evidence you need to rush it!


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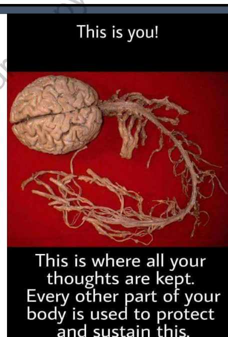

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It’s more than the spine

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HIPS AND SHOULDER

DYNAMIC PRINCIPLES

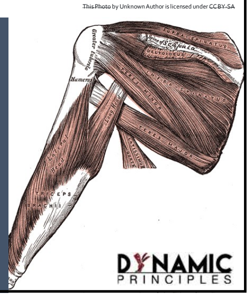
- Multiple abnormalities of the hip are normal imaging findings in asymptomatic individuals, including labral tears (Register et al.)
- Partial and full thickness tears of the rotator cuff are common findings (54%) in asymptomatic shoulders (Sher et al.)
- Labral abnormalities are present 79% of the time in asymptomatic professional baseball players (Miniaci, et al.)
- Pain decreases with age and degenerative changes of the rotator cuff (Vicent et al.)

83

WHAT HAPPENS IF YOU DON’T REPAIR THE ROTATOR CUFF?

- 118 patients age 40-85
- Full-thickness tear of supraspinatus or infraspinatus, confirmed on ultrasound or magnetic resonance imaging
- Symptomatic for a minimum of 3 months
- “Approximately 75% of patients remained successfully treated with nonoperative treatment at 5 years and reported a mean rotator cuff quality-of-life index score of 83 of 100 (SD, 16
- The operative and nonoperative groups at 5-year follow-up were not significantly different (P = .11).”

– Boorman et al.



DYNAMIC PRINCIPLES

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DO R/C REPAIRS HEAL?

Does arthroscopic rotator cuff repair actually heal? – Meyer et al.

- Methods
  - 29 patients (31 shoulders)
    - small or moderate-sized supraspinatus full thickness tear with (7/31) or without (24/31) infraspinatus extension.
    - Rotator cuff MR arthrography was performed by an independent radiologist
- Results
  - The mean follow-up was 49.4 ± 17.3 months.
  - Sixteen patients (17 shoulders) had a rotator cuff MR arthrography.
  - Eighty-eight percent of repairs (15/17) showed a small or a large leakage at the MR arthrography.
  - There was no significant correlation between the clinical and anatomical outcomes.
- Conclusion
  - The interest of this series is to show, at a mid-term follow-up and using an invasive imaging technique, the low rate of tendon-to-bone healing in arthroscopic rotator cuff repair but with a minimal influence on clinical outcome.

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SYSTEMATIC REVIEW - NATURE HISTORY OF FULL THICKNESS R/C TEAR

The Natural History of Full-Thickness Rotator Cuff Tears in Randomized Controlled Trials: A Systematic Review and Meta-analysis – Khatri, et al.

Methods

Review of 57 studies that had study lengths up to 52 weeks

Results

"Patients with full-thickness rotator cuff tears demonstrated a consistent pattern of improvement in Constant score with nonoperative and operative care. The natural history of patients with rotator cuff tears included in RCTs is to improve over time, whether treated operatively or nonoperatively."

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R/C CASE STUDY

Recovery of Range of Motion and Decrease in Pain after Progression of Supraspinatus Tendon Tear: A Case Report – Hagiwara et al.

- 59 y/o sedentary male with 3 months of progressively worsening shoulder pain
- MRI – Mild R Supraspinatus tendon tear
- ROM Severely limited with resting ache
- Several months rehabilitation – No change in function/sx
- MRI shows significant increase in tear size
- Schedules surgery
- Puts on a coat one night waiting for surgery, hears a pop in shoulder and ROM full is restored and pain free
- Cancels surgery

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ROTATOR CUFF REPAIRS?

DYNAMIC PRINCIPLES

Surgery for rotator cuff tears - Cochrane Systematic Review - December 2019

"At the moment, we are uncertain whether rotator cuff repair surgery provides clinically meaningful benefits to people with symptomatic tears; it may provide little or no clinically important benefits with respect to pain, function, overall quality of life or participant-rated global assessment of treatment success when compared with non-operative treatment. Surgery may not improve shoulder pain or function compared with exercises, with or without glucocorticoid injections."

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TOTAL JOINTS

- 40-53% of people who get total joint surgery continue to have pain that is the same or worse than prior to surgery – Liu et al. & Wylde et al.
- For those who previously used opioids, up to 53% of patients who have total knee surgery continue to use opioids prescribed after surgery at 6 months – Goesling
- For those who had no opioids prior to surgery, upto 8.2% continued to use opioids after surgery at 6 months – Goesling

DYNAMIC PRINCIPLES

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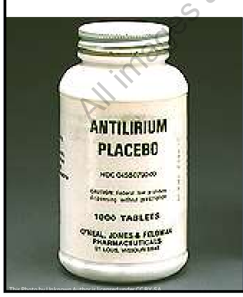
PLACEBO SURGERY

DYNAMIC PRINCIPLES



Knee Arthroscopy
- Both arthroscopic debridement ('cleaning up") and lavage ('washing out') were no better than placebo surgery for moderate to severe osteoarthritis (Mosely et al.)
- Arthroscopic partial meniscectomy for patients age 35-65 with degenerative meniscal tears without knee osteoarthritis with placebo surgery and found that their outcomes were no different (Sihvonen at al.)

Vertebroplasty
- Multiple reviews these studies concur with these conclusions and recommend against the performance of these procedures (Staples et al.)

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PLACEBO SURGERY – CONT.

SLAP Labral Repair

- SLAP repair compared to biceps tenodesis compared to placebo surgery(Schroder et al.)
- No difference between placebo surgery and actual repair at 24 months
  - Placebo surgery had best overall outcome scores first months but evened out at 24 months with the other groups

Subacromial Decompression

- Arthroscopic subacromial decompression, Investigational arthroscopy only (placebo), or no treatment
- Surgical groups had better outcomes for shoulder pain and function compared with no treatment but this difference was not clinically important. Additionally, surgical decompression appeared to offer no extra benefit over arthroscopy only. The difference between the surgical groups and no treatment might be the result of, for instance, a placebo effect or postoperative physiotherapy. (Beard et al.)

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FIMPACT

Finnish Shoulder Impingement Arthroscopy Controlled Trial (FIMPACT) – Paavola, et al.

- **Methods**
  - **Participants** 210 patients with symptoms consistent with shoulder impingement syndrome, enrolled from 1 February 2005 with two year follow-up completed by 25 June 2015.
  - **Interventions** Arthroscopic subacromial decompression (ASD), diagnostic arthroscopy (placebo control), and exercise therapy.
  - **Main outcome measures** Shoulder pain at rest and on arm activity at 24 months.
- **Results**
  - No clinically relevant between group differences were seen in the two primary outcomes at 24 months
  - No between group differences were seen between the ASD and diagnostic arthroscopy groups in the secondary outcomes or adverse events
- **Conclusions**
  - " In this controlled trial involving patients with a shoulder impingement syndrome, arthroscopic subacromial decompression provided no benefit over diagnostic arthroscopy at 24 months."

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KNEE CARTILAGE REPAIRS?

A Controlled Comparison of Microfracture, Debridement, and No Treatment of Concomitant Full-Thickness Cartilage Lesions in Anterior Cruciate Ligament–Reconstructed Knees: A Nationwide Prospective Cohort Study From Norway and Sweden of 368 Patients With 5-Year Follow-up – Ulstein et al.

"Compared with leaving concomitant full-thickness cartilage lesions untreated at the time of ACLR, debridement and microfracture showed no effect on patient-reported outcomes 5 years after surgery."

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THE NEXT SURGERY?

DYNAMIC PRINCIPLES

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- **TWENTY year** follow-up study comparing conservative versus operative treatment of anterior cruciate ligament ruptures. A matched-pair analysis of high level athletes -Yperen et al. Feb 2018
  - 50 High level athletes – primarily soccer!
  - **No statistical difference** between the patients treated conservatively or operatively with respect to ***osteoarthritis or meniscal lesions*** of the knee, as well as **activity level, objective and subjective functional outcome**.
  - ***Surgical repair has NO protective or performance enhancing effect DESPITE THE KNEE BEING 'CLINICALLY UNSTABLE'!!***

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FIRST THING FIRST
RED FLAGS

DYNAMIC PRINCIPLES

- ALWAYS SCREEN THE NERVOUS SYSTEM & CARDIOVASCULAR SYSTEM!
- Some 'Red Flags' are common findings in persistent pain
  - Night sweats, chills, night pain, severity of pain, overwhelming fatigue –
    - Night sweats, chills, night pain - 96% false positives! - Premkuma, et al.
- Be cautious about CA flags! – many people are scared of this due to DR. GOOGLE!
  - Only 4 have shown some utility
    - Unexplained weight loss
    - Being older than 50 years
    - Failure to improve after 1 month
    - ***History of cancer***
    - "Only a history of cancer had a sufficiently high positive likelihood ratio to "meaningfully increase the probability of malignancy" – Cochrane Review for screening red flags in LBP
- "64% of patients with spinal malignancy had no associated red flags" - Premkuma, et al.

95

John - The next 4 years

- Leg pain comes and goes, but back pain worse
- He can't sit for more than 30 minutes
- He can't stand for more than 40 minutes
- He walks for about an hour before he must lay down
- He has stopped exercising other than his PT exercises due to flare-ups
  - He misses his old work outs
- His work is impaired
  - Worry about finances

DYNAMIC PRINCIPLES

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John - The attempts to recover

- Primary care – X-ray & MRI
- Chiropractor – X-ray
- Physical Therapy x 3
  - MDT/Mckenzie
  - Different core exercises are every PT – *Each one telling the other exercises were either wrong or not enough*
  - Regional interdependence manual therapy/MET/manipulation/self mobs
  - Posture education and emphasis on "protecting spine" with neutral spine in lifting/bending
- Orthopedic Spine Surgeon – Additional X-Ray & MRI
- Pain Specialty Anesthesiologist
  - ESI x 2
  - RFA x 1
- Self efforts
  - Stretches & mobility work
  - More core
  - Back braces
  - Protect his back from strain

7 Providers!

97

WHAT FACTORS ARE MOST PREDICTIVE OF PAIN AND DISABILITY?

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Workplace (Think sport for athletes)
- ★ Belief that all pain must be abolished before attempting to return to work or normal activity
- ★ Expectation/fear of increased pain with activity/work
- Poor work history
- Unsupportive work environment

Attitudes and Beliefs
- Belief that pain is harmful, resulting in avoidance and poor compliance with exercise
- ★ Expectation of "techno-fix" for pain

Social/Family
- Overprotective partner/spouse
- Social punitive partner/spouse
- ★ Lack of support to talk about problems

Behaviors
- Passive approach to rehabilitation
- Use of Extended Rest
- ★ Reduced activity with withdrawal from activities of daily living
- ★ Avoidance of normal activity
- ★ Impaired sleep because of pain
- Increase intake of alcohol or similar substances since the onset of pain

Affective/emotions
- ★ Depression
- ★ Feeling useless
- ★ Irritability
- ★ Anxiety about heightened body sensations
- ★ Disinterest in social activity

New Zealand Acute Low Back Pain Guide: Incorporating the guide to assessing psychological yellow flags in acute low back pain, Wellington, 2004.

12 Yellow Flags!

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100

HOW GOOD IS PT CURRENTLY AT PICKING THESE THINGS UP?

"The present study found that PTs cannot estimate the psychological patient reported outcome measures scores, including kinesiophobia, pain catastrophizing, anxiety, and depression, and that clinical experience does not influence the accuracy of PT estimates in patients with LBP through physical therapy evaluation" – Miko et al. 2020

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Additional History about John

- Father was a sales director and an alcoholic
- Mother abused physically
- John and sisters verbally abused
- Hidden from public due to father's income and their appearances
- Struggled with depression & anxiety through adolescence
- Considered himself a "Hard worker" and "self-made" and has been labeled "Type A"
  - He reports he feels anything but now, he feels lazy, but he doesn't know what to do, everything hurts!

DYNAMIC PRINCIPLES

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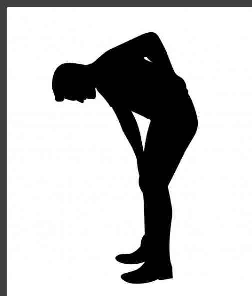
The Event – The other details

- Argued with dad at the gathering
- Felt overwhelmed with projects at work
- Daughter had a lot of medical bills for a childhood illness
- John and his wife's relationship had been strained this last year
- Difficulty sleeping due to pain and his mind racing
- He doesn't hang out with his friends anymore



DYNAMIC PRINCIPLES

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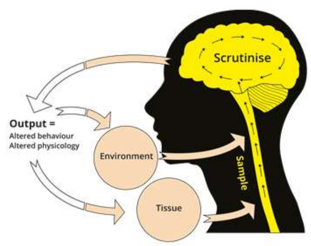
MATURE ORGANISM MODEL

DYNAMIC PRINCIPLES



This Photo was a recreation of the original MOM created by Louis Gifford for to the community

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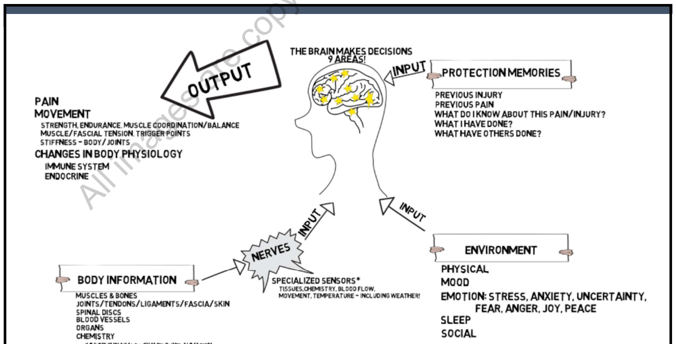

The Complexity of Pain – Available on YouTube and TRUST ME I'M A PHYSIOTHERAPIST Facebook

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MOVEMENT SNACK BREAK!

Stand up Stretch

&

Cervical Rotation Movement Experiment

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Additional Pain Definitions and Basic Nociception

Pain Science, Movement, and Manual Therapy – Overview Course

DYNAMIC PRINCIPLES

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PAIN DEFINITIONS

Nociceptive

Pain that arises from actual or threatened damage to non-neural tissue and is due to the activation of nociceptors.

Classically mechanical/chemical associated pain experience

Neuropathic

Pain caused by a lesion or disease of the somatosensory nervous system.

Classically nerve tissue injury identifiable with diagnostic testing

Nociplastic – ***IASP Official as of February 5th, 2018!***

Pain that arises from altered nociception despite no clear evidence of actual or threatened tissue damage causing the activation of peripheral nociceptors or evidence for disease or lesion of the somatosensory system causing the pain.

Massively debated in IASP how to define "predominantly central sensitized states" due to peripheral and central overlap

Chronic and complex pain – CRPS, fibromyalgia –the classics but even symptomatic osteoarthritis considered a central sensitized presentation – Caveat of peripheral sensitization such as knee with saphenous and femoral n. distributions

DYNAMIC PRINCIPLES

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DYNAMIC PRINCIPLES

OTHER IMPORTANT TERMS

Term	Definition
Peripheral sensitization	Increased responsiveness and reduced threshold of nociceptive neurons in the periphery to the stimulation of their receptive fields.
Central sensitization	Increased responsiveness of nociceptive neurons in the central nervous system to their normal or subthreshold afferent input.
Allodynia	Pain due to a stimulus that does not normally provoke pain.
Hyperalgesia	Increased pain from a stimulus that normally provokes pain.

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DYNAMIC PRINCIPLES

PROTECTION MEMORY?

****A historical reference***

Based on research on neurotags/pain memories, trauma, behavior

Multisystem Behavioral Memory (MBM) with pain experience and/or other symptom disturbance

- Clinical Example: Global and/or local pattern including change in joint and soft tissue mobility that is painful – Think appropriate "limp" during normal healing phases of an ankle sprain

Multisystem Behavioral Memory (MBM) without pain experience and/or other symptom disturbance

- Clinical Example: Global and/or local pattern including change in joint and soft tissue mobility that is not painful – Think maladaptive "limp" after the ankle sprain resolved

Pain and/or sensory disturbance with no clinically observable protective patterning

- Clinical Example: Your assessment reveals nothing but pt. reports pain/sensory disturbance

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WE'RE LOOKING AT BEHAVIOR!

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NOCICEPTION

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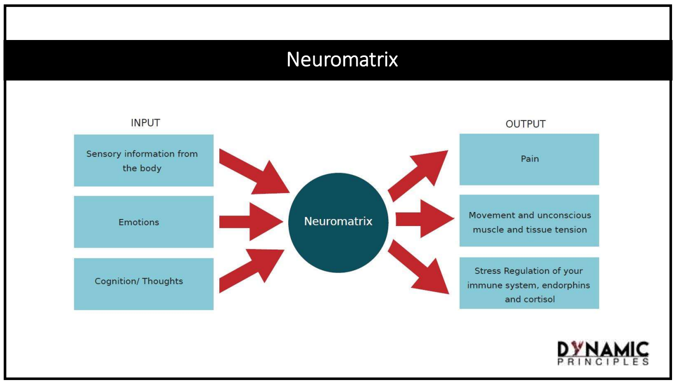
Neuromatrix
INPUT
Sensory information from the body
Emotions
Cognition/ Thoughts
Neuromatrix
OUTPUT
Pain
Movement and unconscious muscle and tissue tension
Stress Regulation of your immune system, endorphins and cortisol
DYNAMIC PRINCIPLES

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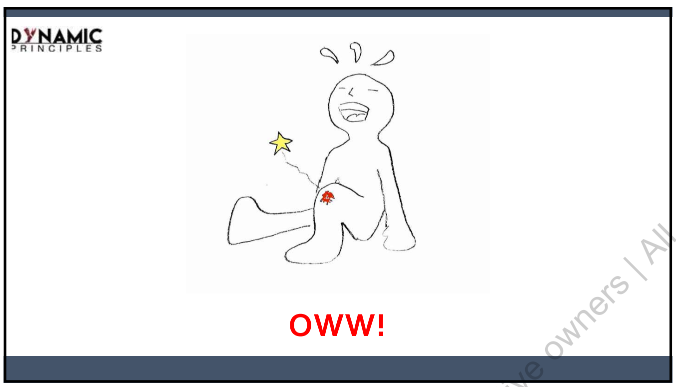
DYNAMIC PRINCIPLES
OWW!

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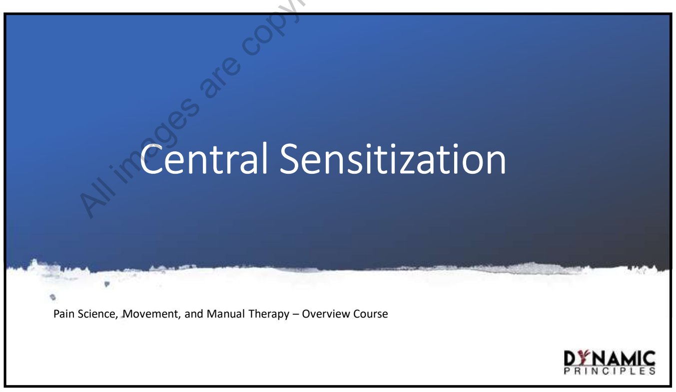
Central Sensitization
Pain Science, Movement, and Manual Therapy – Overview Course
DYNAMIC PRINCIPLES

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CENTRAL SENSITIZATION

DYNAMIC PRINCIPLES

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BELIEVE YOUR PATIENTS!

Weird pain and symptoms are normal biology!

DYNAMIC PRINCIPLES

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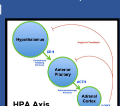
DYNAMIC PRINCIPLES

CENTRAL SENSITIZATION=MULTI-SYSTEM

Immune System – "Classic fibromyalgia" – Flu Like
Endocrine System – Eg: Chronic Fatigue Syndrome/System Exertional Intolerance Syndrome
Sympathetic System – "CRPS/RSD"
GI System – Eg: Irritable bowel syndrome, gluten and other food intolerance
Motor System – Eg: Dystonia
Mixed Systems – Chronic joint pain/Symptomatic OA, tendinopathy, all persistent pain??
Pain in Cancer - Bone cancer induces a unique central sensitization through synaptic changes in a wide area of the spinal cord –Yanagisawa, et al



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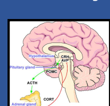

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Hypothalamic-Pituatary-Adrenal axis – (HPA axis)

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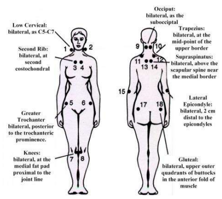
FIBROMYALGIA – THE TENDER POINTS

Wolfe, F. (2003). "Stop using the American College of Rheumatology criteria in the clinic."

- Patients quote "I got all the points, my body must be bad"
- Nerve Mechanosensitivity Pain Pressure Algometry?

We need to be on the same page on fibromyalgia
- The changes in the immune system and endocrine is very important for patient understanding and treatment planning.
- If we want buy in, we need the patients hearing we are saying they same things



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DYNAMIC PRINCIPLES

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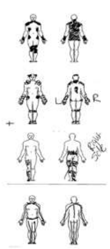

Screening for Central Sensitivity:

Intakes:
- Body maps!
- Central Sensitization Inventory
- Medication Review
  - SNRIs: Cymbalta/duloxetine, Welbutrin/bupropion
  - Nerve Membrane: Gabapentin/Neurontin, Gralise, Lyrica

Objectives for cortical changes
- 2-point discrimination

Other - SPINS
- Severity – Out of proportion?
- Pain Mechanism – Minor/Insidious/Beyond healing?
- Irritability – Too hot too handle?
- Nature – Migrating/Unpredictable?
- Stage – Beyond phases of healing?

DYNAMIC PRINCIPLES

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SMALL FIBER TESTING

Small fiber changes in central sensitization
- Fibromyalgia – De Tommaso et al.
- Chronic Pelvic pain – Chen et al.

Valid Clinical Tests for Small Fiber Changes
- Sharp vs Dull
- Cold vs Warm

DYNAMIC PRINCIPLES

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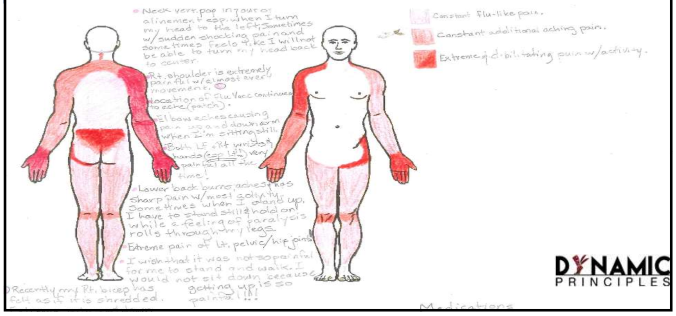
THIS PATIENT’S SELF PORTRAIT IS “NORMAL” WHEN CENTRAL SENSITIZATION IS PREDOMINANT.



DYNAMIC PRINCIPLES

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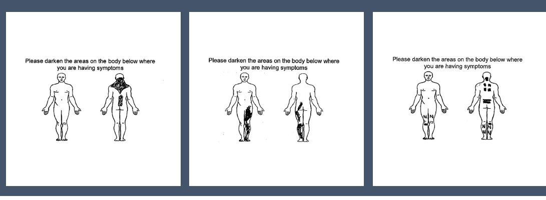

SAMPLE OF OTHER PATIENTS’ BODY MAPS

DYNAMIC PRINCIPLES

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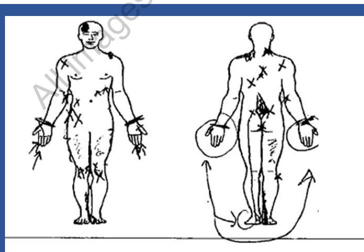
DESCRIBE THE PATIENT



Patient also notes
- Widespread “tingling”
- Spontaneous body wide “Shooting pains”
- Random Insidious onset of widespread body aches

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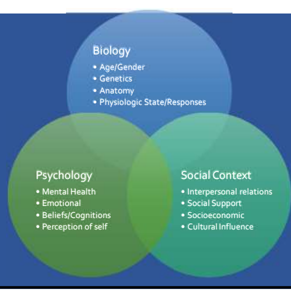
WHAT ABOUT TISSUES AND BIOMECHANICS?

127

DYNAMIC PRINCIPLES

BIOPSYCHOSOCIAL DOES NOT EXCLUDE BIO!!



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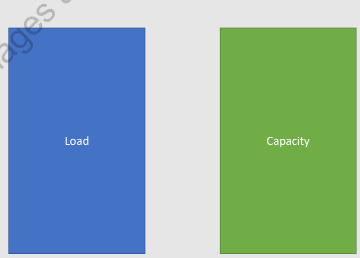

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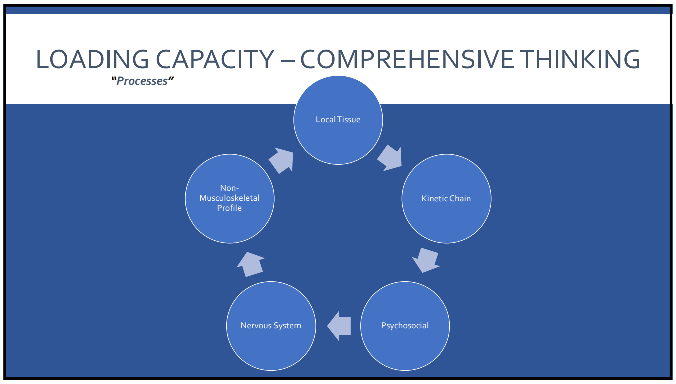
LOADING CAPACITY – COMPREHENSIVE THINKING
"Processes"
Local Tissue
Kinetic Chain
Psychosocial
Nervous System
Non-Musculoskeletal Profile

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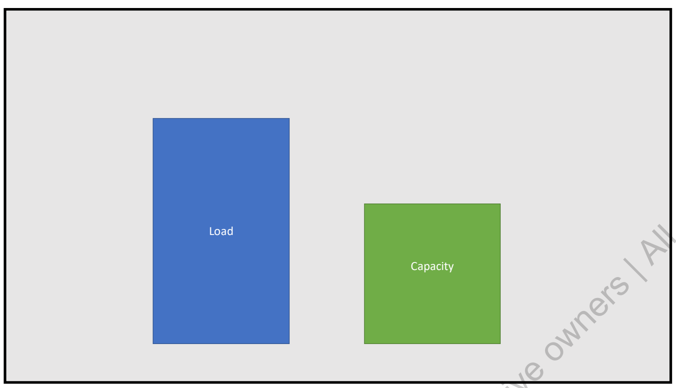
Load
Capacity

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MOVEMENT SNACK BREAK!

Cervical Side-Bend Movement Experiment

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Do we have a problem with our language?

135

COULD LANGUAGE INFLUENCE CHRONICITY/BEHAVIOR?

DYNAMIC PRINCIPLES

- Placebo is not nothing – it is NOT INERT and it is therapeutic
  - Best to consider it a "meaning effect"
  - We will discuss how any increase in awareness engages in biopsychosocial processes that may yield meaning effect.
- Placebo and nocebo effects are powerful
- Placebo effects improve outcomes - including strong analgesia and tissue healing (eg: ulcers)
- Nocebo language has consistent evidence for worsening outcome – Yields physical results
  - **At minimum pain, at worse DEATH – Voodoo curse – (**Lester, D.)
  - **Fake injections create rashes when subjects told they will create rashes and do not create rashes when told they do not** (Petersen, et al)

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WORD VISUALIZATION

What do you visualize in your mind when you see these words?
- Arthritis
- Degeneration
- Wear and tear
- Disc Bulge
- Out of alignment
- Instability

- **What do you think your patients just visualized?**

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IATROGENIC DEVELOPMENTAL FACTORS OF CHRONIC PAIN

Nocebo language may result in iatrogenic chronic pain

Disabling chronic low back pain as an iatrogenic disorder: A qualitative study in Aboriginal Australians - Lin, et al.

- 32 Aboriginal people
- Participants included those who were highly, moderately and mildly disabled.
- Most participants **held biomedical beliefs** about the cause of CLBP, ***attributing pain to structural/anatomical vulnerability*** of their spine.
- Negative causal beliefs and a pessimistic future outlook were more common among those who were more disabled.
- ***This belief was attributed to the advice from healthcare practitioners and the results of spinal radiological imaging.***
- ***Conversely, those who were less disabled held more positive beliefs that did not originate from interactions with healthcare practitioners.***

DYNAMIC PRINCIPLES

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PATIENT BELIEFS IN CHRONIC LBP

When 130 patients with cLBP were surveyed regarding their beliefs of why their pain is chronic they reported – Setchell, et al.

In this order of common beliefs of why they hurt

- #1) It was due to the body being like a 'broken machine'
- #2) It was permanent/immutable
- #3) It was complex
- #4) It was very negative

Most participants indicated that they learned these beliefs from health professionals (89%)

DYNAMIC PRINCIPLES

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#1 IT WAS DUE TO THE BODY BEING LIKE A 'BROKEN MACHINE'

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MOST PARTICIPANTS INDICATED THAT THEY LEARNED THESE BELIEFS FROM HEALTH PROFESSIONALS!

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The words John uses

"Nerve is badly pinched"
- His interpretation of the MRI description from the pain physician

"Back is broken"
- Learned from his primary doctor in description of endplate changes

"Back feels Unstable"
- Learned from the PT(s)

"Pelvis is off"
- Learned from the chiropractor

"I don't trust my body, it feels weak no matter how much I try and make it strong"
- Self perspective

DYNAMIC PRINCIPLES

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WHAT SYMPTOM DID THE PATIENT PRESENT WITH WHEN THEY ARRIVED IN A CLINIC?

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PAIN!!

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WHAT DO WE TEACH ABOUT PAIN?

Anatomy & Pathoanatomy!

What happens when you use exclusively use anatomy and pathoanatomy for education?

- Limited efficacy in decreasing pain and disability
- **Notable increase fear in patients**
- **Fear is associated with increased pain**

(Houben et al & Greene et al.)

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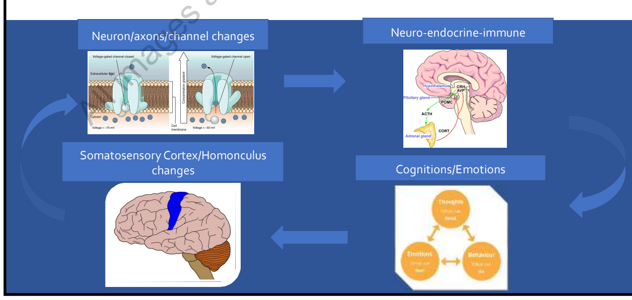
WHAT ABOUT PAIN SCIENCE?



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EDUCATION

Is not straight forward….

148

"Hold language lightly even the things called facts because they are built only on one part of your interactions.." Stephen Hayes

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Permission provided on Louis Gifford Aches & Pains Blog

PEOPLE IN PAIN WANT TO KNOW 4 THINGS..

Louis Gifford

1. What's wrong with me?
2. How long will it take for me to get better?
3. Is there anything I can do to help myself?
4. Is there anything you can do to help me?

5. How much will it cost ?(Adriaan Louw)

DYNAMIC PRINCIPLES

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Some Educational "Add-ins"

Fundamentally	Decrease Nocebo (threatening) language and improve confidence in the human body to create an environment for positive behavioral and functional change
Specifically	**Therapeutic Neuroscience Education (TNE)** ▪ Teaching neuro-immune-endocrine physiology of pain specific to patient client need using practical stories and analogies ▪ De-educate to re-educate **Global Biopsychosocial Principles** ▪ Broad stroke general education **Human Rehabilitation Framework (HRF)** **Other non-nocebo language-based education?**

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IS THERAPEUTIC NEUROSCIENCE EDUCATION HELPFUL?

DYNAMIC PRINCIPLES

12 Randomized Controlled Studies and 2 systematic reviews demonstrate the following effects of TNE alone (Louw et al.)

- Changes in regards to pain beliefs
- Changes in regards to attitudes
- Improved cognition
- Improved physical performance and function
- Increased pain thresholds
- Improved outcomes from exercise
- Decreased brain activation
- Patients able to take on complex pain issues

ALL THESE CHANGE ARE SUPERIOR WHEN COMBINED WITH MOVEMENT AND MANUAL THERAPY!

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TNE IS MORE THAN PAIN

Not a fan of term PNE!

DYNAMIC PRINCIPLES

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EDUCATION ALONE ON ROM

A randomized controlled trial of intensive neurophysiology education in chronic low back pain. – Moseley, Nicholas, Hodges

Education alone resulted in:

- SLR Improved 5 degrees
- Forward trunk flexion - 4cm

Stretching nerve vs muscle descriptors changes SLR! – Coppieters, et al.

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Straight Leg Raise

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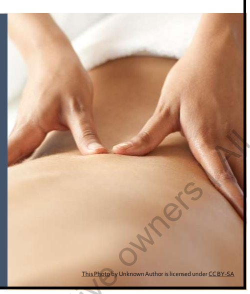
EDUCATION AND MANUAL THERAPY

Language and the humble L5/s1 PA! – Louw, et Al.

- 62 patients with cLBP had previous mechanical tissue based education for manual therapy divided into two groups – Biomechanical Explanation vs. Neuroplasticity Explanation
- Biomechanical – (Overview) "With LBP some levels of the spine stiffen up, they need to be loosened or it is hard to bend forward"
- Neuroplasticity – (Overview) - Given a picture of the somatosensory homunculus and the back being described as being "blurred" and that the manual therapy technique would "sharpen the map"
- Results: The neuroplastic education had a statistically significantly greater improvement in SLR ROM compared the biomechanics group. Not only was it statistically different but clinically relevant(MDC) differences!
- Really cool added detail, all the patients for both groups had manual therapy before and believed it was helpful, so the fact that they got a different explanation than they did in the past still helped improve the immediate results!



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EDUCATION AND… ULTRASOUND??

Examination of word choice in ultrasound in 67 patients with cLBP – Louw, et al.

Control (CG)

- *Ultrasound has been used in the treatment of LBP. Sound waves are generated by the US machine. These sound waves result in an increased circulation in and around the injured area, including blood flow, which is needed for recovery. You might feel some warmth or heating with the treatment, which is common. We use US gel to allow the sound waves to enter your tissues and keep moving it to cover the affected area, in a figure-8 fashion.*

Inflated Education (EG)

- *Ultrasound has been used in the treatment of LBP. Sound waves are generated by the US machine. These sound waves result in an increased circulation in and around the injured area, including blood flow, which is needed for recovery. You might feel some warmth or heating with the treatment, which is common. We use US gel to allow the sound waves to enter your tissues and keep moving it to cover the affected area. Typically we move the US head in a figure-8 fashion, but some new research has indicated if we perform it clockwise, it helps reduce pain even more.*

Extra-Inflated Education (EEG)

- *Ultrasound has been used in the treatment of LBP to help with healing process and control pain. It utilises sound waves which help with the healing properties of tissues. Most often individuals see immediate improvements in pain and being able to bend and move further. Sometimes mild heat may be felt with the use of ultrasound but not always.*
- ***Specifically for your back, new research has shown that by applying the ultrasound clockwise, which we are going to do today, improves the effects of the ultrasound. This improved effect helps unwind the tightness felt and eases back and leg pain a lot. The clockwise ultrasound usually will allow you to bend further forward when we test you after treatment and also you will be able to raise your leg up higher.***

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Results: Both EG and EEG groups showed a statistically significant improvement for SLR (p< 0.0001), while the CG did not. The EEG group participants were 4.4 times (95% confidence interval: 1.1 to 17.5) more likely to improve beyond the MDC than the CG.

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EDUCATION VS SYMPTOM CLASSIFICATION

Population: 207 patients 18-60 years with LBP for at least 4 months

Two Treatment Groups:

Group 1: Received an educational approach designed to improve confidence in the resiliency of the spine and 2 movements: Seated flexion and rotation

Group 2: Symptom Classification Based Treatment:

- MDT(Certified MDT) Directional Preference Classification
- Stabilization Classification
- Intensive Dynamic Exercise Classification
- IN ADDITION: group 2's physical therapists could at their own discretion refer for pharmacology, manual therapy, or physician for injection to complement their symptom based plan

Outcome Measures: Pain, Activity Limitation, FABQ, Back Beliefs, physical activity, work ability, quality of life – Measured at 2, 6, and 12 months

Results: The primary outcome measures, there was a non-significant trend towards activity limitation being reduced mostly in the educational group, although of doubtful clinical relevance. Regarding secondary outcomes, improvement in fear-avoidance beliefs was also better in the educational group. All other variables were about equally influenced by the two treatments. The median number of treatment sessions was 3 for the educational group and 6 for the physical training group.

Conclusion: "We have demonstrated that, among patients with cLBP, the educational/cognitive intervention with few consultations was at least as effective as an individualized, multidisciplinary physical-training approach. 'At least' refers to the observed overall trend of more improvement in activity-limitation with EDUC." - Sorensen et al. (2010)

DYNAMIC PRINCIPLES

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EDUCATION AND EXERCISE

Pain Neurophysiology Education and Therapeutic Exercise for Patients With Chronic Low Back Pain: A Single-Blind Randomized Controlled Trial. – Pardo, et al.

- Participants: 56 participants (28 in each with no dropouts) aged 20-75 with =/>6 months of LBP
- Interventions: Motor control, stretching, and aerobic exercise alone or combined with TNE conducted in two 30-50 minute sessions in groups for 4-6.
- Outcomes: Recorded immediately after treatment and 3 months follow-up Primary = NPRS | Secondary = Pressure pain threshold, finger-to-floor distance, Roland-Morris Disability Questionnaire, Pain Catastrophizing Scale, Tampa Scale for Kinesiophobia, and Patient Global Impression of Change.
- **Results: Large change in pain scores (-2.2; -2.93 to -1.28; P<.001; d=1.37) and moderate effect size on secondary outcomes for PNE + Exercise compared to exercise alone**

DYNAMIC PRINCIPLES

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DYNAMIC PRINCIPLES

EDUCATION FOR WHO?

EVERYONE!

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BIOPSYCHOSOCIAL MODEL AND ATHLETES

"Pain in elite athletes commonly exists without ongoing injury, and injury does not necessarily cause pain. Therefore, it is critical to define the nature/type of pain in the elite athlete. The sports medicine practitioner must understand the neurophysiological, biomechanical, and psychosocial contributors to such pain"

- Brian Hainline, MD – NCAAA Chief Medical officer – Speaking at IASP World Congress in 2018

International Olympic Committee Consensus Statement for treatment of pain in elite athletes ***- 2017***

- Specific to physical therapy, the IOC recommends that physical therapists who treat athletes should be trained to
  - "*identify and address inaccurate conceptualisations of pain and injury plus psychosocial and contextual influences on pain*"
  - and be able to educate "*the athlete regarding the role of the central nervous system in pain, especially in chronic pain*".

Secretary of Defense Comprehensive Policy of Pain

- "Pain is a uniquely individual, subjective experience and, because of this, must be treated using multidisciplinary, biopsychosocial approaches."
  - The Implementation of a Comprehensive Policy on Pain Management by the Military Health Care System for ***Fiscal Year 2015***

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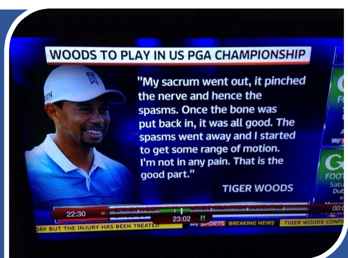
WHY WORDS MATTER IN SPORTS MEDICINE: WHERE IS TIGER'S SACRUM?



2013?

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TIMELINE

- **May 9, 2010:** Withdraws from the final round of The Players Championship, citing a bulging disk. He later said it was a neck issue that caused tingling in his right side, and that it first became a problem as he began practicing harder for his return to the Masters a month earlier.
- **Aug. 21, 2013:** Famously drops to his knees after one shot because of back spasms.
- **March 31, 2014:** Has first back surgery for a pinched nerve.
- **Sept. 16, 2015:** Undergoes second back surgery — a micro-discectomy — to remove a disc fragment that was pinching his nerve.
- **October 2015:** Has a third back procedure to relieve discomfort in his back and sets no timetable for his return to the PGA Tour.
- **April 20, 2017:** Undergoes a fourth back surgery. The spinal fusion, labeled a 'success' by his surgeon, Dr. Richard Guyer, to alleviate pain he had been experiencing in his back and leg.

"Asked if it's disconcerting that his health is worse than a few months ago, Woods replied: "Just the way it is. Father Time and some of the procedures I've had. *Just the way it's going to be.*" – July 18, 2019

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WHY WORDS MATTER IN SPORTS MEDICINE: WORDS OUTLAST TREATMENT

Letter from parents of a young basketball athlete with 6 month hx B patellar tendinosis and notable chondromalacia:

"He assured her that the pain she was feeling when she played a lot of basketball ***was more of a defense mechanism than actually something wrong with her knees,*** so she could push through it when she had to. Kyra had a terrific showing this summer and could not have played any better."

Please Note: Words MUST be combined with manual therapy and exercise – She had as much, if not more manual therapy than Tiger!

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PLANTING SEEDS

- It's "ok" to not have them be receptive and disappear
  - Often you'll see them again in a few months or years once they exhausted all their other options
  - 3 year example
- Not everyone is ready
- Keep refining your "***Word*** **–** Movement and Manual Therapy"
  - Listen, practice, fail, learn, repeat!
  - Learn from those who have been doing this for some time
- Do your best to try and help them "flip the switch" and move forward and be confident that even if it isn't obvious, you have given the most current world class evidence-based care they could have!

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"I read some data just last night that just kind of horrified me. There's a part of our brain that's close to the sense of self, especially the stories we tell of the kind of ego-based self. Now here's what horrified me. The sensory and sensory-motor input that's coming up goes through that area as a hub, and if the inputs don't fit the story, it cuts it off right there. In other words, your clients literally are living in a world in which they don't know what's going on because they're living inside a concept. There isn't even a way neurobiologically to get some of the information that's right in front of them." - Steven Hayes

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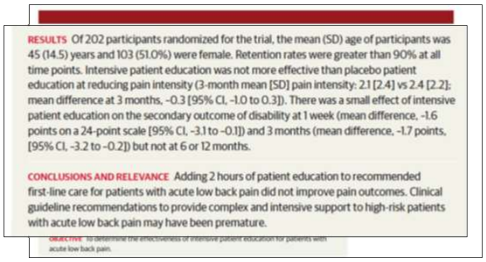
IMPORTANT STUDY


RESULTS Of 202 participants randomized for the trial, the mean (SD) age of participants was 45 (14.5) years and 103 (51.0%) were female. Retention rates were greater than 90% at all time points. Intensive patient education was not more effective than placebo patient education at reducing pain intensity (3-month mean [SD] pain intensity: 2.1 [2.4] vs 2.4 [2.2]; mean difference at 3 months, −0.3 [95% CI, −1.0 to 0.3]). There was a small effect of intensive patient education on the secondary outcome of disability at 1 week (mean difference, -1.6 points on a 24-point scale [95% CI, -3.1 to −0.1]) and 3 months (mean difference, -1.7 points, [95% CI, -3.2 to −0.2]) but not at 6 or 12 months.

CONCLUSIONS AND RELEVANCE Adding 2 hours of patient education to recommended first-line care for patients with acute low back pain did not improve pain outcomes. Clinical guideline recommendations to provide complex and intensive support to high-risk patients with acute low back pain may have been premature.

OBJECTIVE To determine the effectiveness of intensive patient education for patients with acute low back pain.

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IT IS A GOOD STUDY

…BUT SOME CONSIDERATIONS

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PLACEBO?

- Is it placebo? Or just equivalent to another effective intervention?
  - 1-hour sessions of listening
    - Average Physician Time:
      - *13-24 minutes*
        - *Source: Medscape's 2017 Physician Compensation Report.*
  - "The sessions mimicked all aspects of the patient education sessions (listening, showing interest, and attention of the clinician) but without the education component."
    - "Patient surveys have consistently shown that they want better communication with their doctors." – Duffy et al.
    - "Unfortunately, there is evidence that suggests good communication skills are not universally practiced by physicians" – Berman and Chutka
  - Communication skills such as listening, showing interest, and attention of the clinician are NOT standard care, they are non-inert, they are therapeutic!
    - "Studies show that communication training for clinicians produces small effects in improving patients' satisfaction with care or reducing pain and disability in primary care and rehabilitation settings." - Oliveira, et al.

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ADDITIONAL THOUGHTS

- Acute LBP with high risk population (40% converted to cLBP)
  - Acute pain for someone at high risk may require time for a form of "grief" (see Hayes quote) before education may be beneficial
- Return to work not measured
  - Disability was significantly less in the TNE group in first 3 months – Could this have allowed earlier return to work?
    - Earlier return to work allows for earlier social circle recovery which may have a >12 month benefit – Social factors can take time to have an effect
- Emphasis of the study on pain relief
  - TNE vs PNE
    - PNE and TNE are often interchangeable – MY BIAS – They are different
    - TNE is broad spectrum – beliefs, behaviors, social, and measurable physiologic changes indep of pain changes
      - Pain experience is only one part and it's made up of the whole

169

THE "NO DUH" PART

What viewpoint is your client coming from?

…What does it feel like to shift your viewpoint only part of the way? Do you feel uncomfortable?

…………Yearning for Coherence?

…………………And how about "Hats"? When the client leaves your presence, what do their minds do?

What if we could teach skills which facilitate the ability to shift perspectives? Skills which improve psychological flexibility?

Skills that fit into the rehabilitation things you already know?

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"THE ELECTRIC LIGHT DID NOT COME FROM CONTINUOUS IMPROVEMENT OF CANDLES" – OREN HARARI

171

Pharmacology and Surgery

Pain Science, Movement, and Manual Therapy – Overview Course

DYNAMIC PRINCIPLES

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PHARMACOLOGY

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BASED ON WHAT YOU HAVE LEARNED SO FAR ...WHAT IS A PAIN MEDICATION?

Is it accurate to call any medication as pain medication? It depends on what physiology is contributing to the pain experience!!

DYNAMIC PRINCIPLES

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WHICH ONE MORE EFFECTIVE FOR POST OP PAIN?

Medication	Type of medication	# of patients studied	NNT
Diclofenac 100 mg	Prescription NSAID	545	
Celecoxib 400 mg	Prescription NSAID	298	
Ibuprofen 400 mg	Prescription NSAID	5456	
Naproxen 400 mg	Prescription NSAID	197	
Ibuprofen 200 mg	OTC NSAID	3248	
Oxycodone 10 mg + acetaminophen 1000 mg	Prescription opioid	83	
Morphine 10 mg intramuscular	Injectable opioid	948	
Oxycodone 5 mg + acetaminophen 325 mg	Prescription opioid	149	
Tramadol 50 mg	Prescription opioid	770	

(Bandolier, 2007)

Bandolier, 2007

Number Need to Treat (NNT) of 2 or 3 required to be effective for pain

DYNAMIC PRINCIPLES

175

WHICH ONE MORE EFFECTIVE FOR POST OP PAIN?

Medication	Type of medication	# of patients studied	NNT
Diclofenac 100 mg	Prescription NSAID	545	1.8
Celecoxib 400 mg	Prescription NSAID	298	2.1
Ibuprofen 400 mg	Prescription NSAID	5456	2.5
Naproxen 400 mg	Prescription NSAID	197	2.7
Ibuprofen 200 mg	OTC NSAID	3248	2.7
Oxycodone 10 mg + acetaminophen 1000 mg	Prescription opioid	83	2.7
Morphine 10 mg intramuscular	Injectable opioid	948	2.9
Oxycodone 5 mg + acetaminophen 325 mg	Prescription opioid	149	5.5
Tramadol 50 mg	Prescription opioid	770	8.3

(Bandolier, 2007)

Bandolier, 2007

Number Need to Treat (NNT) of 2 or 3 required to be effective for pain

DYNAMIC PRINCIPLES

176

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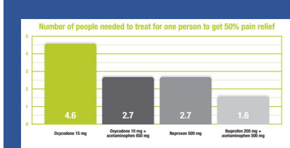
Ibuprofen 400 mg	Prescription NSAID	5456	2.5
Naproxen 400 mg	Prescription NSAID	197	2.7
Ibuprofen 200 mg	OTC NSAID	3248	2.7
Oxycodone 10 mg + acetaminophen 1000 mg	Prescription opioid	83	2.7
Morphine 10 mg intramuscular	Injectable opioid	948	2.9
Oxycodone 5 mg + acetaminophen 325 mg	Prescription opioid	149	5.5
Tramadol 50 mg	Prescription opioid	770	8.3

(Bandolier, 2007)



Bandolier, 2007

Number Need to Treat (NNT) of 2 or 3 required to be effective for pain – Closer to 1 is best

DYNAMIC PRINCIPLES

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GENERAL MEDICATIONS ASSOCIATED WITH PAIN TREATMENT

- **Nerve Membrane Stabilization Agents** – Commonly marketed as anticonvulsant but tremendously important with neuropathy, CRPS, and central dominant pain such as fibromyalgia diagnosis
  - Most common:
    - Gabapentin (Generic) – Neurotin – brand name / Gralise is time release
  - Lyrica – Pregabalin
  - SNRIs (NOT SSRIs like Prozac!) also acted as membrane stabilization agents –
    - Bupropion – Branded as Welbutrin
  - Duloxetine- Branded as Cymbalta most commonly
- **CNS Depressants (AKA –" Muscle Relaxers")**
  - Methocarbamol – Most common brand name: Robaxin
  - Cyclobenzaprine – Flexeril
  - Tizanidine

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- SUPPORT YOUR PHYSICIAN/PHARMACOLOGY TEAM MATES – EDUCATE YOUR PATIENTS HOW THEIR MEDICATIONS INFLUENCE PAIN!

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OPIOIDS

- Act on opioid receptors
  - mu (μ_1) typically targeted but also kappa and delta
- Can works well with acute nociceptive pain based on ability to reduce nociceptive messages notably at spinal cord, but also in brain
- Other pain modifying effects associated with its serotonin boosting effects, hence the improved sense of well-being/mood when taking an opioid.
  - Historically poppies were the "happy herb"

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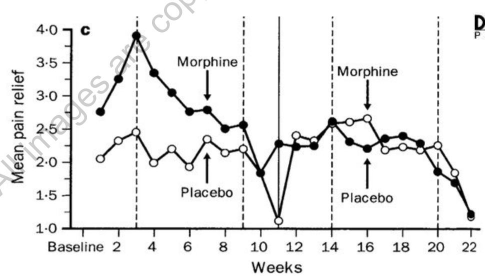

NOCICEPTION IS NEITHER SUFFICIENT NOR NECESSARY TO PRODUCE PAIN!

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OPIOIDS CONT

Side effects well known, chemical dependency and withdrawal more common than marketed, opioid induced hyperalgesia (chronic use can result in increased pain experience) is a mess. This being said a low dose opioid such as tramadol may be a long term part of some chronic pain treatment plans, often more so because the difficulty completing weaning some patients of opioids, the risk of chemical withdrawal effects outweighs the risks of the dose

*****Be aware of risk of serotonin syndrome when patients have been prescribed opioids and SSRI/SNRIs – High levels of serotonin build up in the brain causing severe possible fatal side effects. Symptoms include:***

> ***Agitation; hallucinations; rapid heart rate; fever; excessive sweating; shivering or shaking; muscle twitching or stiffness; trouble with coordination; and/or nausea, vomiting, or diarrhea. Symptoms generally start within several hours to a few days of taking an opioid with another medicine that increases the effects of serotonin in the brain,***

Also, adding to the massive list of side effects are include cortisol regular, although rare, dramatic adrenal insufficiency which will require corticosteroid treatment

DYNAMIC PRINCIPLES

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OPIOIDS TERMINAL ILLNESS

End of Life Note: "The treatment of incurable cancer, end stage lung disease, and other end-of-life situations are notable examples where opioid medications are absolutely indicated. Although opioid pain killers are not very good medications for the treatment of pain, they are very strong psychotherapeutic agents. They are excellent at relieving anxiety and treating depression for a limited time. Opioids cause beneficial changes to brain serotonin, epinephrine, norepinephrine, dopamine, and endorphins. For short term, end-of-life situations, these neuropsychiatric effects are likely beneficial." DR. DONALD TEATER, M.D - National Safety Counsel

DYNAMIC PRINCIPLES

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COMMON OPIOIDS

- Morphine – the prototype opioid
- Fentanyl – holy hell – nuff said – can't believe we didn't stop here and realize we had a problem but there is even stronger synthetic opioids available!
- Oxycodone vs. Oxycontin – oxycodone is generic, Oxycontin is an extended release oxycodone sold by big pharma as 12 hour dosing, research shows 4-6 hours before commonly metabolized, withdrawal hell for many patients when using it as prescribed!
  - Percocet – oxycodone with acetaminophen
    - Acetaminophen -Tylenol or Paracetamol
- Hydrocodone
  - Vicodin – Hydrocodone with acetaminophen
- Norco - Hydrocone with acetaminophen
- Tramadol
  - AKA Ultram

DYNAMIC PRINCIPLES

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NALTREXONE

- Revia and Vivitrol are brand names
- Label use is for preventing relapse from alcohol and opioid abuse
- Reversibly blocks or attenuates opioid receptors
- Low dose naltrexone (LDN) -some research of efficacy for neuropathic pain

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TOPICAL NSAIDS

Topical NSAIDs – Cochrane

- "There is good evidence that some formulations of topical diclofenac and ketoprofen are useful in acute pain conditions such as sprains or strains, with low (good) NNT values. There is a strong message that the exact formulation used is critically important in acute conditions, and that might also apply to other pain conditions. In chronic musculoskeletal conditions with assessments over 6 to 12 weeks, topical diclofenac and ketoprofen had limited efficacy in hand and knee osteoarthritis, as did topical high-concentration capsaicin in postherpetic neuralgia. Though NNTs were higher, this still indicates that a small proportion of people had good pain relief." – Derry et al.

185

MARY JANE

The Effects of Cannabis Among Adults With Chronic Pain and an Overview of General Harms: A Systematic Review – Nugent et al.

"From 27 chronic pain trials, there is low-strength evidence that cannabis alleviates neuropathic pain but insufficient evidence in other pain populations. According to 11 systematic reviews and 32 primary studies, harms in general population studies include increased risk for motor vehicle accidents, psychotic symptoms, and short-term cognitive impairment."

186

MARY JANE CONT.

Effect of cannabis use in people with chronic non-cancer pain prescribed opioids: findings from a 4-year prospective cohort study.

FINDINGS:

1514 participants from Aug 20, 2012, to April 14, 2014.. At 4-year follow-up, compared with people with no cannabis use:

- Participants who used cannabis had a greater pain severity score (risk ratio 1·14, 95% CI 1·01-1·29, for less frequent cannabis use; and 1·17, 1·03-1·32, for daily or near-daily cannabis use),
- Greater pain interference score (1·21, 1·09-1·35; and 1·14, 1·03-1·26), - (self-reported consequences of **pain** on relevant aspects of a person's life and may include the extent to which **pain** hinders engagement with social, cognitive, emotional, physical, and recreational activities.
- Lower pain self-efficacy scores (0·97, 0·96-1·00; and 0·98, 0·96-1·00),
- Greater generalised anxiety disorder severity scores (1·07, 1·03-1·12; and 1·10, 1·06-1·15).
- We found no evidence of a temporal relationship between cannabis use and pain severity or pain interference, and no evidence that cannabis use reduced prescribed opioid use or increased rates of opioid discontinuation.

187

MARY JANE CONT.

Does marijuana use decrease opioid use?

"Our data indicate that self-reported marijuana use during injury recovery was associated with an increased amount and duration of opioid use. This is in contrast to many patients' perception that the use of marijuana reduces their pain and therefore the amount of opioids used."

- Bhashyam, Abhiram R., et al. "Self-Reported Marijuana Use Is Associated with Increased Use of Prescription Opioids Following Traumatic Musculoskeletal Injury." JBJS 100.24 (2018): 2095-2102.

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PSYCHEDELICS

Pending, but potential!

Key appears guidance during the "trip"

189

PROCEDURES

- Epidural Steroid Injection - ESI
- Radiofrequency Ablation - RFA
- Local anesthetic/cortisone
  - Facet injections

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SURGERY

191

EXTREMELY BRIEF

Spinal Decompression Surgery
- Discectomy
  - Micro -?
- Laminectomy
- Laminotomy
- Fusion
  - Cervical very successful, lumbar less so

Total Joints
- Rule of thumb – Can't bend them, can't restore volitional control – replace them!

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SURGERY HAS A PLACE

- There comes a time when the nerve does not have enough space to breath – It's ok to recommend surgery!
- Total Joints have a place
  - Keep in mind with joint replacement of knee, capsule is kept, think innervation sensitization! Hip replacement less so since capsule is removed.
- You should be integral in their decision makes and be delivering pre-surgical pain neuroscience education to maximize their surgical outcome!

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PRE-SURGICAL THERAPEUTIC NEUROSCIENCE FOR SPINE SURGERY

Preoperative pain neuroscience education for lumbar radiculopathy: a multicenter randomized controlled trial with 1-year follow-up. Louw, et al.

- **ONE 30-minute education session prior to spine surgery**
- **No statistical significance:**
  - **Back Pain**
  - **Leg Pain**
  - **Catastrophization**
  - **Fear Avoidance**
- **But…**
  - Health care utilization post-LS also favored the NE group (*P* = 0.007) resulting in 45% less health care expenditure compared with the control group in the 1-year follow-up period.
- **3 Years Later:**
  - **Three-year follow-up of a randomized controlled trial comparing preoperative neuroscience education for patients undergoing surgery for lumbar radiculopathy**
  - Cumulative cost difference of 60%

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Introduction to Language Change

Pain Science, Movement, and Manual Therapy – Overview Course

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Challenges of TNE and BPS education strategies

- Thoughts cannot be changed; we cannot REMOVE a thought.
  - Hats!
- Challenging thoughts often backfire in the long run.
- We can add new knowledge though.
- If you add new knowledge, why should they shift if it doesn't fit their values or viewpoint.
  - If they don't know their values or viewpoint, why should they shift?
- If our "Education" does not match our interventions and prescriptions viewpoint – Coherence could be broken!

"Hold language lightly even the things called facts because they are built only on one part of your interactions.." Stephen Hayes

- More on this tomorrow in Behavior!

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THERAPEUTIC NEUROSCIENCE EDUCATION

DYNAMIC PRINCIPLES

- ISPI Therapeutic Neuroscience Education – Adriaan Louw
- NOI Explain Pain – Lorimer Moseley & David Butler
- Recovery Strategies Workbook – Greg Lehman – FREE!

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DYNAMIC PRINCIPLES

TEACHING

- Teaching is multimodal!
- LOTS AND LOTS OF PICTURES
  - Consider ISPI TNE Cards
- Videos
- Physical

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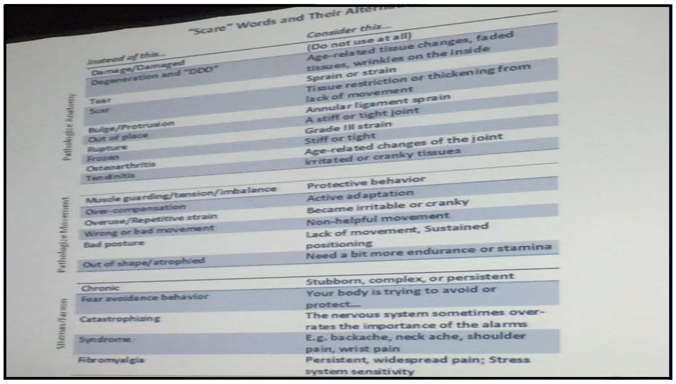

"Scare" Words and Their Alter…

Instead of this…	Consider this…
Damage/Damaged	(Do not use at all)
Degeneration and "DDD"	Age-related tissue changes, faded tissues, wrinkles on the inside
Tear	Sprain or strain
Scar	Tissue restriction or thickening from lack of movement
Bulge/Protrusion	Annular ligament sprain
Out of place	A stiff or tight joint
Rupture	Grade III strain
Frozen	Stiff or tight
Osteoarthritis	Age-related changes of the joint
Tendinitis	Irritated or cranky tissues
Muscle guarding/tension/imbalance	Protective behavior
Over-compensation	Active adaptation
Overuse/Repetitive strain	Became irritable or cranky
Wrong or bad movement	Non-helpful movement
Bad posture	Lack of movement, Sustained positioning
Out of shape/atrophied	Need a bit more endurance or stamina
Chronic	Stubborn, complex, or persistent
Fear avoidance behavior	Your body is trying to avoid or protect…
Catastrophizing	The nervous system sometimes over-rates the importance of the alarms
Syndrome	E.g. backache, neck ache, shoulder pain, wrist pain
Fibromyalgia	Persistent, widespread pain; Stress system sensitivity

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WEAR AND TEAR?

- **Acute comparison Loaded (running) vs. Unloaded (walking) - Hyldahl et al.**
  - Running decrease knee intra-articular pro-inflammatory cytokine concentration and facilitate cartilage oligomeric matrix concentrations
- **Epidemiologic comparison of runners vs. walkers (89,377 people) - Williams**
  - Runners had 15% to 18 % lower rates of hip OA, and 35% to 50% lower rates of hip replacement
- **Dose Dependent - Recreational running vs walking vs. competitive - Alentorn-Geli et al. without and WITH OA of hip and knee- (n = 114,829 individual)**
  - Control – (sedentary and walkers) – 10.5% odds ratio of hip and knee OA progression
  - Competitive – 13.3% odds ratio
  - ***Recreational – 3.5%***
- **Running strengthens the intervertebral disc - Belavy, et al.**
  - Runners (20-40km) 11.2% & Joggers (50km+) 9.2% with 5 years hx of consistent running compared to sedentary
  - Further expanded an algorithm that fast walking or slow running has most anabolic capacity for the IVD
  - First study to show that spinal discs responds positively to exercise – More to come

WEAR AND REPAIR!

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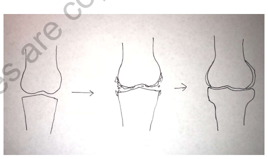

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THOUGHT QUESTION

204

An ignored REPAIR trail

- Changes in bone remodeling in the elderly might precipitate irregularities in the articular cartilage resulting in subsequent degeneration – Johnson, 1962!!
- Radin et al. then speculated that increased bone mass and thickening of the subchondral bone may in fact be the primary event of joint degeneration.
- Radin and Rose proposed that increases in the stiffness of the underlying bone were associated with cartilage degeneration.
- Two potential changes can result from increased subcontrol bone growth:
  1. Typically joint bone assists in high load tolerance by deformation and microfractures within the tissue, thus ensuring that the energy is dissipated. When subchondral bone thickens, the shock-absorbing capacity of the bone is drastically reduced, shear stresses increase between the bone-cartilage interface due to increased bone stiffness
  2. Other evidence does not link to shear stresses but rather the increased bone thickness limits the metabolic capacity (recovery) of the cartilage regeneration
- All of this

"..suggests subchondral bone changes with cartilage defects are primary, and subchondral bone change precedes cartilage damage in early knee OA" – Ding et al.

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WHAT ABOUT THE CARTILAGE

Exercise prevents the articular cartilage loss of the increase chondral bone growth from osteoarthritis.

- "During exercise the cartilage in joints such as the hip and knee is squashed. This mechanical distortion is detected by the living cells in the cartilage which then block the action of inflammatory molecules associated with conditions such as arthritis."
  - Mechanical loading inhibits cartilage inflammatory signalling via an HDAC6 and IFT-dependent mechanism regulating primary cilia elongation. Osteoarthritis and Cartilage, 2019

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Please don't leave the words "degeneration" or "arthritis" undefined even if the patient seems unaffected by it!

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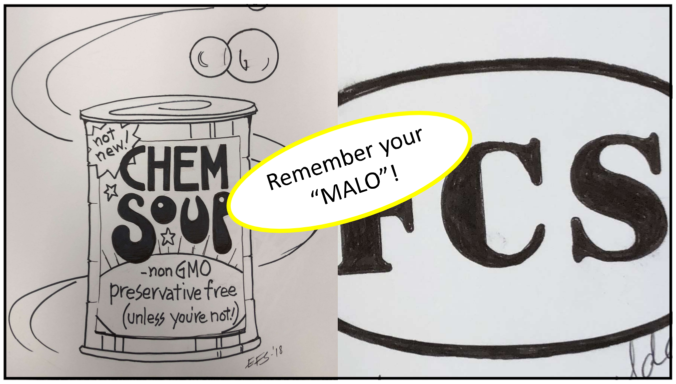
not new!
CHEM SOUP
-non GMO
preservative free
(unless you're not!)
Remember your "MALO"!
FCS

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DYNAMIC PRINCIPLES
▪ Physical
▪ Mind
▪ Emotions
▪ Social

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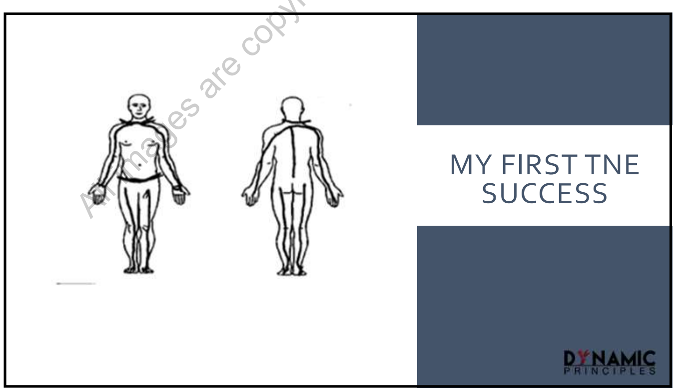
MY FIRST TNE SUCCESS
DYNAMIC PRINCIPLES

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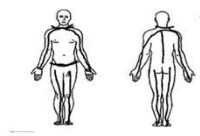
MY FIRST SUCCESS CONT

- 44 y/o male
- Arrived at PT and reported to front desk "I don't do PT, I'm coming here because my dr. told me to, I won't be coming back" – Front desk asked "Even it helps?" – Patient response "Even if it helps, I'm not coming back after today"
- Medical hx: HTN, DM, obesity, multiple fx
- Pain hx: Widespread pain, worsened after TKA, belief "excessive damage to body over years"
- Pain better: Nothing | Worse: Moving
- Interventions: "Everything" – Meds/PT/chiro..



DYNAMIC PRINCIPLES

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MY FIRST SUCCESS CONT

- Slumped, angry, cursing
- On arrival "Everything hurts" – All orthopedic testing painful
- Notable B hip arthropathy and hip flexion PROM was maybe 30 degrees before he is squirmy
- significant loss of ROM "everywhere" – Pt. very adamant about loss of reaching behind back..
- Marked neurodynamic mechanosensitivity and mobility (cogwheel feel) – particular ULNT1
- Lumbar 2-point discrimination: B=>100mm
- Pain Pressure Threshold at B PSIS =<1.0#
- Review of findings
- TNE "Fire hydrant"

DYNAMIC PRINCIPLES

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MY FIRST SUCCESS CONT

Post-TNE
- Upright posture – "light in eyes"
- 20 minutes of questions about education and his symptoms (luckily I had lunch after his eval!)
- Hip flexion improved to 85 degrees with firm end feel – tolerated hip mobilization – "felt good"
- Gentle median n. slider – pt. immediately reached behind back without difficulty
- After minimal plinth intervention – Pt. stands up and reports feeling better – reach for shoes with less effort
- Pt. schedules for 4 weeks of PT on leaving

DYNAMIC PRINCIPLES

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MY FIRST SUCCESS CONT

- From "can't touch the spine" to manipulation tolerance by end of session
- ROM and strength keeps improving with minimal effort
- Function improves – family reports remarkable changes
- Pt. reports he hardly hurts anymore
- Pt. has nasal septum repair between sessions – has some complications but bounces back with continued global improvement
- 10 Sessions to independence – 1 year follow-up still doing well

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THE BITTER PILL

215

TOP 11 PT MISUNDERSTANDINGS WHICH MAY CONTRIBUTE TO CHRONICITY

1. Bending and slouching is dangerous
2. Core instability
3. Alignment, positional faults, balance
4. Osteoarthritis
5. Tendinopathy
6. Trigger points/Myofascial restrictions / scar tissue
7. Scoliosis
8. Posture
9. Patellar tracking
10. "Muscle imbalances"
11. Crepitis!

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IMPORTANCE OF EXPLAINING JOINT NOISE

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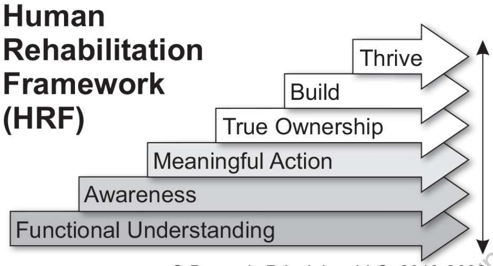
Brief History of Movement with Pain Framework

- Functional Contextualism
- Relational Frame Theory
- ACT
- Process-Based Approach Therapy
- Human Rehabilitation Framework

1

Human Rehabilitation Framework (HRF)



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DYNAMIC PRINCIPLES

2

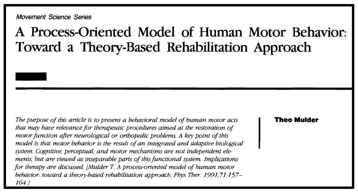
Human Rehabilitation Framework (HRF)

- Process-Based Approach
- Transdiagnostic
  - When you stub your toe, your flesh is falling off, have a specific disease, you have chronic back pain, shoulder pain, knee pain, or you have a headache. You can use it quickly, individually, specifically to your client. All without protocols, just processes!
- Process-Based Approaches also support structural and physiologic changes but those are only bonuses
- The framework is flexible – Adaptable to inevitable scientific advances

3

The Sun

Process Based Approach to Movement – New?



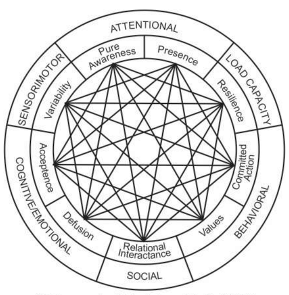
Movement Science Series

A Process-Oriented Model of Human Motor Behavior: Toward a Theory-Based Rehabilitation Approach

The purpose of this article is to present a behavioral model of human motor acts that may have relevance for therapeutic procedures aimed at the restoration of motor function after neurological or orthopedic problems. A key point of this model is that motor behavior is the result of an integrated and adaptive biological system. Cognitive, perceptual, and motor mechanisms are not independent elements, but are viewed as inseparable parts of this functional system. Implications for therapy are discussed. [Mulder T. A process-oriented model of human motor behavior: toward a theory-based rehabilitation approach. Phys Ther. 1991;71:157–164.]

Theo Mulder

4



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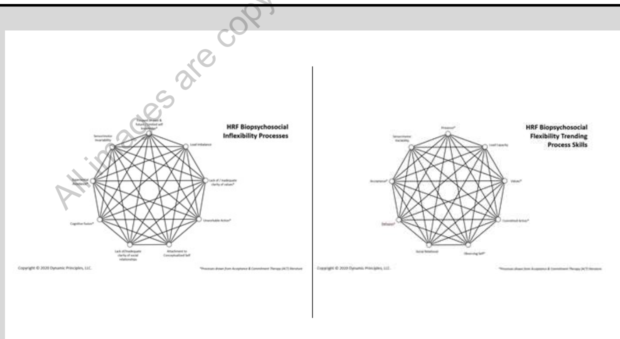

6

Inflammation and Healing

Pain Science, Movement, and Manual Therapy – Overview Course

DYNAMIC PRINCIPLES

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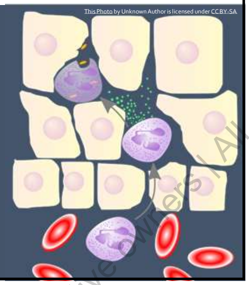
INFLAMMATION

DYNAMIC PRINCIPLES

Local inflammatory is produced by Resident Immune Cells

- Macrophages, dendritic cells, histocytes, Kupffer cells and mast cells come in – ***HEALING SOUP***
- Tumour Necrosing Factor (TNF) is produced by macrophages and is responsible for the cardinal signs of inflammation
- TNF basically blows everything up and allows the local response last longer
- Recent data shows that at about approximately 4 days unless there was notable re-injury or infection, the local response is unlikely driving inflammation

Local inflammatory response is short-lived and require constant stimulation to produce!



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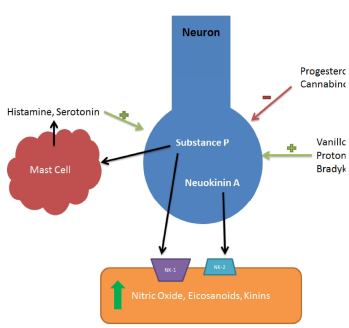
INFLAMMATION

- Resident immune factors increase nociceptor activity which then bombard the DRG and results in substance P release which further increases vasodilation and inflammation.
- Communication to the spinal cord and brain is constant, not only by nerve impulse bombardment but because of newly identified glial communication (albeit slower)
- Ultimately continuing inflammation is sustained or inhibited by the ***INFLAMMATORY REFLEX!***

DYNAMIC PRINCIPLES



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INFLAMMATORY REFLEX

- Resident Inflammatory products in damaged tissues transmit info via afferent nerves to parts of medulla oblongata – think autonomics – fast/near instant
- Here activation of vagus efferent activity inhibits cytokine synthesis ***(healing soup)*** through the anti-inflammatory pathway ('the inflammatory reflex').
- Activation of the sympathetic outflow by flight/flight responses or pain, or through direct signaling, can increase local concentrations of adrenaline and noradrenaline, which can suppress inflammation further.
- "The nervous system reflexively regulates the inflammatory response in real time, just as it controls heart rate and other vital functions." - Tracey

Long story short – *inflammation is a neuro-endocrine-immune process*, not just some little local tissue issue!

DYNAMIC PRINCIPLES

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INFLAMMATION UPDATED

- What this means is that RICE (**or should I say – POLICE**?) is not the only way decrease inflammation!
- Parasympathetic Stimulation – IE: breathing, education, etc could be beneficial for regulating inflammatory behavior
- Tools: EDUCATION to provide alternative narrative to fear of big swollen joints/tissues from a neuro-endocrine-immune basis, sleep, awareness, behavior change, GMI??

DYNAMIC PRINCIPLES

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DYNAMIC PRINCIPLES

TISSUES HEAL!!

With or with you!

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THE GREAT HEALING RESEARCH MISDIRECTION

1,000s of studies of multiple interventions across many disciplines have demonstrated statistically significant improvements (*which is different than clinically significant*!) in chemical mediators associated with healing.

- Very few have examined timelines of influence on healing across months and years
- ***NONE*** of shown clinically significant improvements in tissue healing (besides skin) in comparison to normal healing timelines or placebo.
- PRP and regenerative medicines being the most common (think big pharma influence..) but also surgery - Meyer et al.
  - "Therapeutic measures for effective intervention and prevention of tendon injuries have progressed with limited success because of the scarcity of data that describes basic mechanisms for effective tendon function and response to injuries" - Andarawis-Puri, et al.

Conservative rehabilitation also has no impact on tissue healing (unless you do something stupid)

Eccentrics nor manual therapy enhance healing!! –Malliaras, et al., Lederman et al.

- Beyond minimal nutrient requirements (adequate protein ~70gram a day and vitamin c – 85mg) – special nutrition does not enhance on healing - Pullen et al, Bhasin et al.

DYNAMIC PRINCIPLES

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THE GREAT HEALING RESEARCH MISDIRECTION

The majority of healing assumptions have been based on skin

- Some things DO help skin heal better but it functions in a different environment than everything underneath it! – Zhang et.

There is a major difference between improved PAIN AND FUNCTION and HEALING!

- Most studies which conclude that an intervention helped the outcome do not provide evidence of tissue healing
- FUNCTIONAL AND SUBJECTIVE OUTCOMES ARE POORLY ASSOCIATED WITH HEALING!

There is a difference between DELAYED and *ACCELERATING* healing

- Delayed healing can occur when tissues do not have adequate blood flow, nutrition, or stress regulation (such as proper immobilization for fracture)
  - Bone stimulators get a lot of press but:
    - " Based on moderate to high quality evidence from studies in patients with fresh fracture, LIPUS does not improve outcomes important to patients and probably has no effect on radiographic bone healing. " –Schandelmaier, et al.
- Doing stupid things during healing phases can delay healing, but even when tissue healing is delayed:

DYNAMIC PRINCIPLES

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TISSUES HEAL!

DYNAMIC PRINCIPLES

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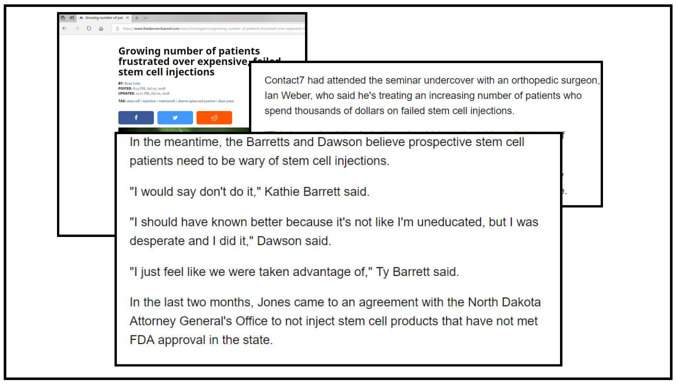

Growing number of patients frustrated over expensive, failed stem cell injections

BY: Ryan Luby
POSTED: 8:15 PM, Jul 20, 2018
UPDATED: 11:27 PM, Jul 20, 2018
TAG: stem cell | injection | west2north | denver spine and posture | dean jones

Contact7 had attended the seminar undercover with an orthopedic surgeon, Ian Weber, who said he's treating an increasing number of patients who spend thousands of dollars on failed stem cell injections.

In the meantime, the Barretts and Dawson believe prospective stem cell patients need to be wary of stem cell injections.

"I would say don't do it," Kathie Barrett said.

"I should have known better because it's not like I'm uneducated, but I was desperate and I did it," Dawson said.

"I just feel like we were taken advantage of," Ty Barrett said.

In the last two months, Jones came to an agreement with the North Dakota Attorney General's Office to not inject stem cell products that have not met FDA approval in the state.

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WHY DOES IT MATTER?

You, even if you deny it, consciously or subconsciously think they are broken

They, even if they deny it, consciously or subconsciously think they are broken

17

LET THE BODY HEAL ITSELF, LET'S HELP THE PERSON!

TISSUES HEAL!! With or without us!

- We need to shift our treatment ***toward the WHOLE person***, not just the tissue
- Pain persists despite tissue healing and pain can be improved WHILE and AFTER healing
- Movement problems continue despite healing and can be improved WHILE and AFTER healing
- People struggle with life despite tissues healing and can be improved WHILE and AFTER healing
  - Sleep, breathing/relaxation techniques, education modulates AND gives hope and motivation
  - If they understand the biopsychosocial role in their injury and symptoms they are more willing to seek counseling support early rather than late

DYNAMIC PRINCIPLES

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REVIEWING HEALING TIME LINES

- **Bone** – 3-8 weeks depending on size/complexity – can take anything on by 3 months
  - Total joints still remodel for up to 1.5 years
- **Muscle** – 6-8 weeks
- **Ligament** – 6 weeks to 6 months
- **Cartilage** – if it heals - 2 months tops
- **Nerve** – 1mm a day for small nerves
  - 5mm a day for large nerves
  - 1 inch a month
  - Myelin sheath may or may not return!

******NERVE PHYSIOLOGY CHANGES AFTER TRAUMA COULD BE PRESENT UP TO 3 YEARS AFTER INJURY***

DYNAMIC PRINCIPLES

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DYNAMIC PRINCIPLES

PAIN AND HEALING

- Chronic or persistent pain is considered 3-6 months post injury:
  - I'd opt for at least 6 months based on healing timelines.
- Pain associated with healing can be modulated from the moment of injury on
- It is possible to make someone pain free with movement, (even intensive movement!) when their tissue is not ready for it, another reason to understand pain biology AND healing times!
  - Countless examples of people with major fractures and other tissue injuries who didn't know they injured anything until later
  - Personal examples
  - Referrers forget! EG: multiple trauma including surgical fixation referred as a "Chronic pain syndrome" from massive MVA 3 months prior!!

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TISSUE QUALITY

No differences at 1-3 years in symptoms or performance (measured in athletes) regardless of how nasty the hamstring or Achilles tendon looks after a tear heals.

Scar tissue is functional

80% viability far exceeds the highest forces that could be placed on an elite athlete - It is good viable functional material!

Long term imaging studies for every other area of the body concurs, pain and movement not effected based on visual representation of tissue quality on imaging.

We want to make a resilient tissue with our exercise prescription but realize it already robust and adaptable even if it's ugly.

DYNAMIC PRINCIPLES

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REPETITIVE STRESS INJURY?

- RSI is a questionability entity
  - Not much evidence for tissue or cellular change -Pullen, K., et al., Van Tulder, Maurits, Antti Malmivaara, and Bart Koes
- Very little research on tissues quality in question, and those studies that have can't find them all the time.
  - Too many observational studies!!
- Bio-Psycho-Social!
- Psychosocial aspects of work far greater predict outcomes than anything at the biologic level
  - NEURO-ENDOCRINE-IMMUNE response
  - Emotional and cognitive related movement changes – more on this later

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Posture and Tissue Issues

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POSTURE

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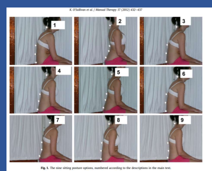
WHAT IS GOOD POSTURE?

- When looking at sitting posture – O'Sullivan et al.
  - 295 physiotherapists from across the world
  - They completed a Back Beliefs Questions (BBQ) and were instructed to select what they perceived as the best sitting posture from a sample of nine options that ranged from slumped to upright sitting



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K. O'Sullivan et al. / Manual Therapy 17 (2012) 432–437

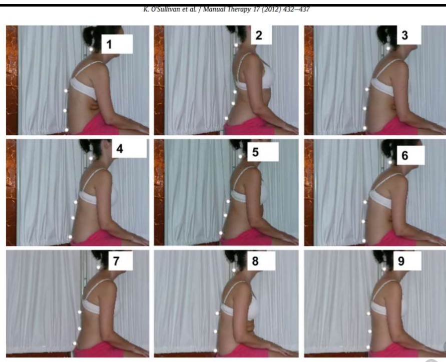

Fig. 1. The nine sitting posture options, numbered according to the descriptions in the main text.

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WHAT IS GOOD POSTURE?

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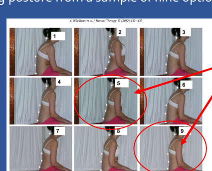

85% selected one of these two postures

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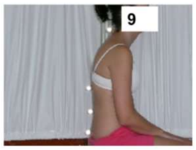

What is good posture?

- Those PTs who selected the more upright sitting posture had more negative LBP beliefs on the BBQ
- No agreements were reached on what a "neutral" posture is
- Which posture was considered "good" also varied by the country

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LITERATURE REVIEW

DYNAMIC PRINCIPLES

- **Neck Posture**
  - 1,108 Adolescents (17 y/o) – Richards et al.
    - No association between sagittal plane 2D subgrouping for neck pain or HA
  - 107 adults (=/>45 y/o) - Grob, et al.
    - No association between X-ray imaging and neck pain or HA
  - Systematic review of cervical curvature, posture, pain, muscular spasm – Gay, RE
    - No association between any variables and symptom presentation
- **Low Back**
  - 321 adults age 18-55 – Pope et al.
    - No association between lumbar curve or leg length and LBP
  - 600 adults (~43 y/o) -Nourbakhsh & Arab
    - No associated between size of the lumbar lordosis, pelvic tilt, leg length discrepancy, and the length of abdominal, hamstring, and iliopsoas muscles and LBP
  - Systematic Review of 54 studies - Christensen and Hartvigsen J.
    - No association between sagittal spinal curves and pain or health

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LITERATURE REVIEW – OPPOSING VIEW

DYNAMIC PRINCIPLES

- Decreased Sacral slope and lumbar lordosis was associated with pain in 2D sagittal observation standing posture - Chaléat-Valayer et al.
- X-ray imaging of thoraco-lumbar-pelvic curvature in sitting demonstrated than "less neutral" postures were ***weakly*** associated with LBP in adolescents -Smith et al.
- **Problem with association – Cannot demonstrate causation**
  - The experience of pain and of emotional distress changes postures
    - Introducing a painful stimulus introduces sagittal plane curvature change –Hodges et al.
    - Moderate to severe depression is associated with classic "poor postures" – O'Sullivan et al.

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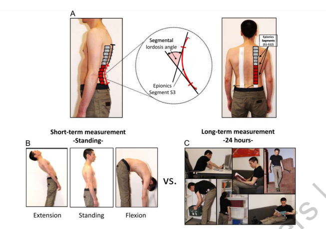
A MOMENT IN TIME

- **Spinal posture variation during the day - Dreischarf et al.**
  - 208 adults with no LBP volunteered to have their lumbar spinal postures monitored through electronic sensors for 24 hours
  - Average range of change during the day was 8-33 degrees of lumbar lordosis!
- Additional Questions to ponder:
  - How many different ways do people sit, stand, or lift in a typical day?



Dreischarf, Marcel, et al. "Differences between clinical "snap-shot" and "real-life" assessments of lumbar spine alignment and motion–What is the "real" lumbar lordosis of a human being?." *Journal of biomechanics* 49.5 (2016): 638-644.

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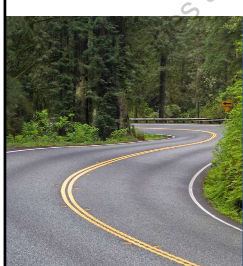
SCOLIOSIS



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- Back pain through a lifetime (50-year study) no different among individuals up to 80 degrees of scoliosis!!! – Weinstein et al.
- The best measured outcomes of aggressive non-surgical interventions to change scoliosis comes to around ***4 degrees of improvement*** – Lenssick et al.
  - Involves life altering extensive time-consuming behaviors to achieve – both 30-45 minutes a day of movements and 2+ session at clinic.
  - Quality of life decreases for what?

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SCOLIOSIS CONSERVATIVE INTERVENTIONS

14+ degree change studies? -Mordecai, Dabke

- Studies that reported "significant" changes in the Cobb angle after treatment were of small magnitude and did not appropriately report inter or intra-observer error rate.
- All studies had poor statistical analysis and did not report whether the small improvements noted were maintained in the long term.

Overview of conservative treatments in studies - Weis

- "Most of the studies included patients not yet or no more at risk for being progressive.
- Additionally, the papers on adults with scoliosis (conservative vs. surgical) have a follow-up period too short to draw any conclusions as complications of surgery in most of the cases appear more than 5 years after surgery.
- There was no outcome paper on PT in patients with idiopathic scoliosis at risk for being progressive followed from the premenarchial status until skeletal maturity. Therefore, only bracing can be regarded as being evidence based in the management of scoliosis patients during growth.
- There is little evidence that PT (including Schroth) have beneficial effects on spinal curvatures.

Cost to Benefit Ratio

"This study questions the value of nonoperative treatment commonly used for adult scoliosis patients. Documented costs are substantial and no improvement in health status was observed. " – Glasman et al.

DYNAMIC PRINCIPLES

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DYNAMIC PRINCIPLES

SCOLIOSIS SURGICAL INTERVENTION

Multicenter Trial

477 adolescent idiopathic scoliosis surgical corrective interventions – 2-year outcomes

"Curve correction improves patient's self-image ***whereas pain and poor function before surgery carry over after surgery***. Patients with less spinal appearance issues (higher body mass index, Lenke 3 curves) are less happy with their results. Except in surgical patient selection, many of these factors are beyond physician control."

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SCOLIOSIS - THOUGHTS

DYNAMIC PRINCIPLES

Beside pain misunderstanding, this may be biomechanical misunderstanding

Facets that shorten on one side also widen in normal vertebral alignment variation, they also follow function – Due to more right-handed individuals most indicate shorter and wider L thoracic facts and thinner R facets leading to L rotation appearance on imaging – Angles of inclination are also variable.

Similarly, the facets widen greater and variable angles based on rotational points of increasing scoliosis indicating forces may be equally distributed across the same amount of surface area despite vertebral alignment variation. Capsular and articular variation likely similar, allowing more adaptation to ipsilateral loading than we perceive.

We ROBUST and we are ADAPTIVE

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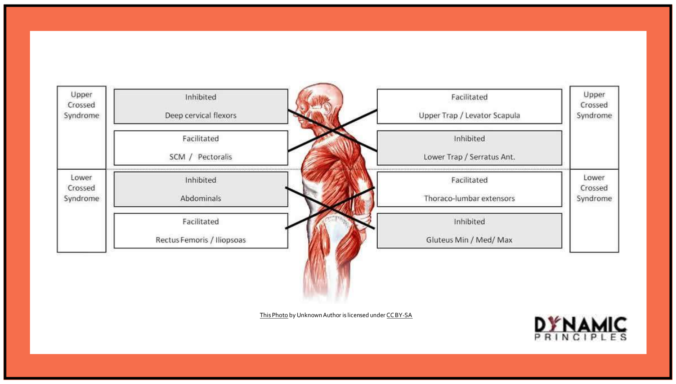
Upper Crossed Syndrome
Inhibited
Deep cervical flexors
Facilitated
SCM / Pectoralis
Lower Crossed Syndrome
Inhibited
Abdominals
Facilitated
Rectus Femoris / Iliopsoas
Facilitated
Upper Trap / Levator Scapula
Inhibited
Lower Trap / Serratus Ant.
Facilitated
Thoraco-lumbar extensors
Inhibited
Gluteus Min / Med/ Max
Upper Crossed Syndrome
Lower Crossed Syndrome
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DYNAMIC PRINCIPLES

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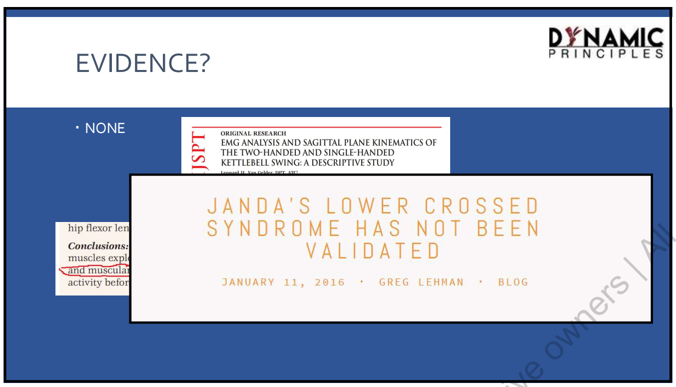
EVIDENCE?
DYNAMIC PRINCIPLES
• NONE
ORIGINAL RESEARCH
EMG ANALYSIS AND SAGITTAL PLANE KINEMATICS OF THE TWO-HANDED AND SINGLE-HANDED KETTLEBELL SWING: A DESCRIPTIVE STUDY
JANDA'S LOWER CROSSED SYNDROME HAS NOT BEEN VALIDATED
JANUARY 11, 2016 · GREG LEHMAN · BLOG

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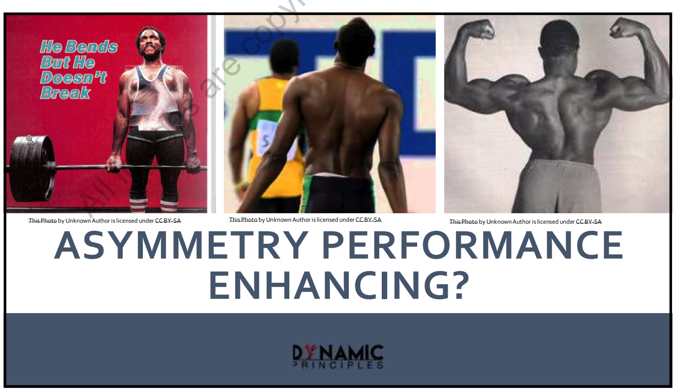
He Bends But He Doesn't Break
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ASYMMETRY PERFORMANCE ENHANCING?
DYNAMIC PRINCIPLES

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TISSUE ISSUES

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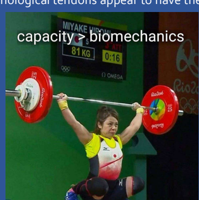
LOAD CAPACITY - KEY TO TRAINING AND REHAB

- **Tendon Scientist Jill Cook best described this principle**
  - "Our ability to tolerate load is more important than posture/biomechanics."
  - "even extensively pathological tendons appear to have the capacity to tolerate very high sporting loads"



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SIDE NOTE – SUBACROMIAL BURSAS

- **The relationship between subacromial bursa thickness on ultrasound and shoulder pain in open water endurance swimmers over time – Couanis et al.**
- Methods
- 21 Open Water Marathon Swimmers
- U/S Imaging x 3
  - 4 months prior to the race
  - 2 weeks prior to the race
  - 1 week after the race
- Results
- "SAB thickness increases with increasing swimming training. Commonly, this increase is not correlated to pain, suggestive of a painless adaptive process. The significant correlation between pain and SAB thickness soon after an exacerbating event suggests that painful acute SAB thickening is a different entity to chronic, painless adaptive SAB thickening. "

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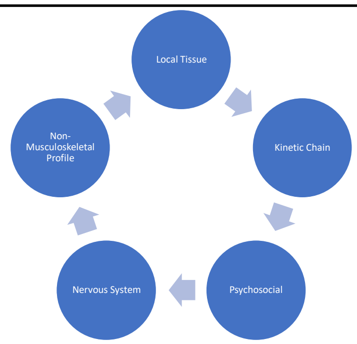

Load Capacity

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- Physical
- Mind
- Emotions
- Social

REMEMBER THIS GUY?

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LOAD CAPACITY – LOCAL TISSUE

- **Local Tissue**
  - Where in the healing timeline? Tissue type specific!
    - Bone – 3-8 weeks depending on size/complexity – can take anything on by 3 months – Total joints still remodel for up to 1.5 years but clear for everything by 3 months
    - Muscle – 6-8 weeks
    - Ligament – 6 weeks to 6 months
    - Cartilage – if it heals - 2 months tops
    - Nerve – 1mm a day for small nerves, 5mm a day for large nerves, ~1 inch a month – myelin sheath may or may not return
  - How conditioned is it to mechanical and specific metabolic demands of the function?
    - Maximal force tolerance
    - Isometric/Isokinetic/Concentric/Eccentric
    - Anaerobic/aerobic
  - PT as a whole are not well educated on strength and conditioning and not providing adequate loads for improving local tissue capacity

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HOW TO LOAD TISSUES WELL

- Calm the major sensitivity
- Keep an eye on sensitivity during the plan
- Load it as tolerated
  - Focus on the movements the tissues must do
- For athletes: LOAD THE CRAP OUT OF IT IN EVERY WAY YOU CAN THINK !
  - We don't load our athletes enough
  - Focus on the movements the tissues must do

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LOAD CAPACITY – KINETIC CHAIN

DYNAMIC PRINCIPLES

- **Kinetic Chain**
  - How conditioned and mobile are the neighbors from head to toe for the function?
  - How variable across the neighbors are they?
  - Are they aware of their whole body?

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LOAD CAPACITY – NON-MUSCULOSKELETAL

DYNAMIC PRINCIPLES

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- **Non-Musculoskeletal Profile**
  - Sleep
  - Age
  - BMI
  - Metabolic factors
  - Hormonal factors
    - Endocrine/Immune
  - Heart rate variability
  - Medication
  - Diet

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LOAD CAPACITY –NERVOUS SYSTEM

DYNAMIC PRINCIPLES

- **Neuro-endocrine-immune**
  - CNS/PNS
    - SNS & ANS
  - Neurodynamics
  - Cortical inhibition
  - Central sensitization
  - Laterality
  - Interoception
  - Response to exercise
  - Variability
  - Protection Memory/Neurotags

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LOAD CAPACITY – PSYCHOSOCIAL

DYNAMIC PRINCIPLES

- **Psychosocial factors**
  - Stress
  - Mood
  - Fear
  - Thoughts
  - Beliefs
  - Motivation
  - Family
  - Friends
  - Work
  - Cultural/societal

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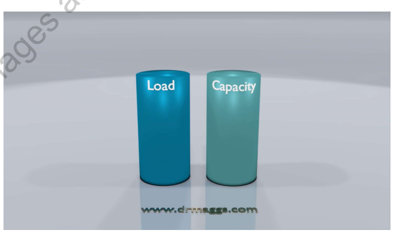
Loading Capacity - Video



https://vimeo.com/339686848?fbclid=IwAR2gswgGwoBBZDhZ9iffEM_blhQ-K4oEq9reu9MWEQKemI19oD4pkDnc3M8

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Best Acceleration Drill

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Finding Ease in Sitting Lab

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Modern Movement Science meets Pain Science

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DYNAMIC PRINCIPLES

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MOVEMENT

DYNAMIC PRINCIPLES

55

Definition of Human Movement: A process that varies from a simple reflex loop to a complex network of neural patterns that communicate throughout the Central Nervous System (CNS) and Peripheral Nervous System (PNS).

Contemporary Issues and Theories of Motor Control, Motor Learning, and Neuroplasticity (Roller et a

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DYNAMIC PRINCIPLES

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REAL TALK

Our framework of movement is not "the right one"

The only consistent theme in biomechanics and movement science is that we do not work like machines, movement is complicated and messy.

We're providing just ONE way to navigate this messiness with the hope of making your job easier in the long run and improve the odds that your patients will keep moving in the long run.

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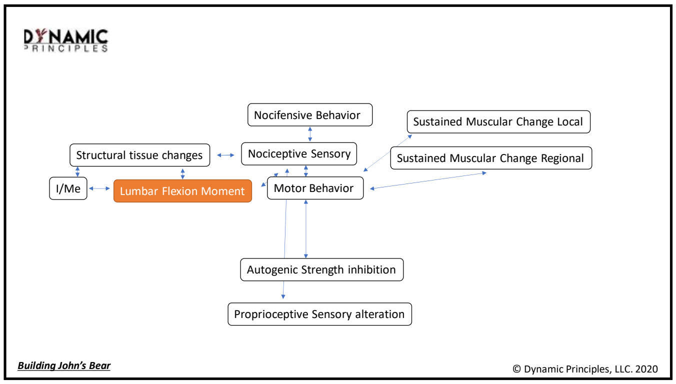

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MOTOR CONTROL

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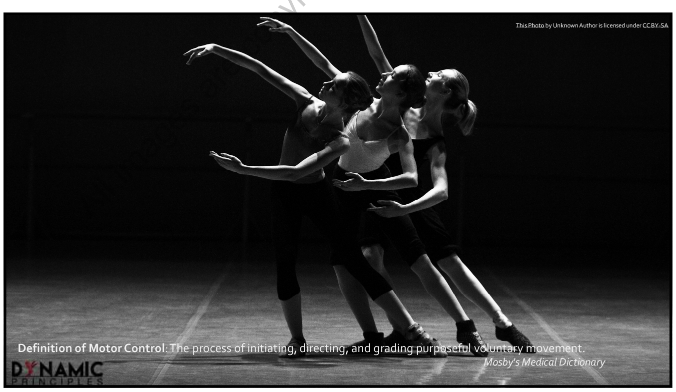

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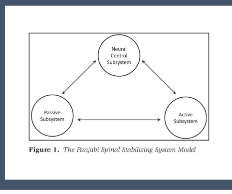
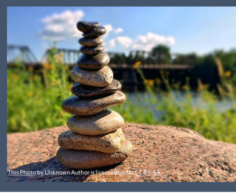


Figure 1. *The Panjabi Spinal Stabilizing System Model*



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STABILIZATION MODEL

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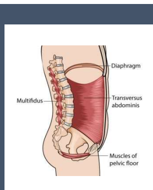
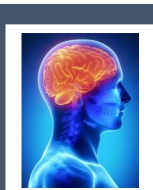
THE STABILIZERS





- The tVA does not stabilize the spine symmetrically, it is asymmetrically active during function – Allison, et al 2008.
- The multifidi activate asymmetrically and cannot function as stabilizers in the traditional model – Okubo et al. 2010
- The tva, multifidi, and obliques activate asymmetrically and according to functional demands – Davarian, et al. 2014
- Motor Patterns change based on expectation (van Dieën et al.)
  - Thinking and expectation of weight/load tune specific muscular activity for the load and increases speed of lift
  - Absence of knowledge about the load increases spinal stability and decreases speed of lift

Your thoughts, your expectations, your goals, and the context influence how your body coordinates movement!

..Sensing a theme here?

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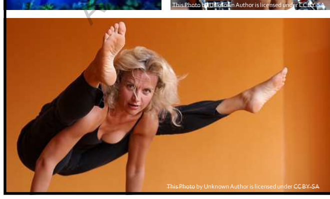

ARE PEOPLE IN PAIN UNSTABLE?

Core activation (van Dieën et al.)
- People in pain change muscle activation patterns in ways which INCREASE spinal stability.

Muscular Stiffness (Masaki et al.)
- People with LBP have greater stiffness on ultrasound imaging than those without LBP.

Posterior Chain/Gluteals (Pirouzi et al.)
- People in pain have INCREASED posterior chain activation in normal motions like rotation.

When lifting an object – (Falla et al.)
- People in pain – Have significant DECREASES in lumbar muscular activation variability – lifting is done the same way repeatedly.
- People without pain – Significant increases in lumbar muscular activation variability – lifting is done differently with each repetition.

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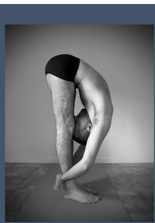
ARE PEOPLE IN PAIN UNSTABLE? - CONT



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- **When bending – (Shojaei et al.)**
  - People in pain – Have significant DECREASES in lumbopelvic coordination – they didn't want to move as much at the low back and pelvis in bending – Decreased lumbopelvic flexion.
  - People without pain - Have significant INCREASES in lumbopelvic coordination – they were more willing to move at both the low back and pelvis – Increased lumbopelvic flexion.
- **Chronic ankle instability** results in less ankle, knee, and hip variability (more stable) than healthy controls in balance (Van Deun)
  - And in jumping tasks (Brown)

DYNAMIC PRINCIPLES

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Abdominal Draw-in/conscious TVA activation (Aussie phenomena)
Decreases sagittal plane stability

Abdominal Bracing
Functionally limits transverse movement and results in compensatory behavior with function behaviors such as bending

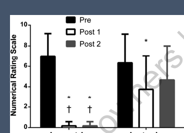
Both behaviors are metabolically inefficient

Both behaviors are consistent with pain/protective behavior
Why reinforce a problematic behavior?

Why pain reduction when performed?
Both behaviors exert pain decreases due to isometric descending modulation function

DYNAMIC PRINCIPLES

STABILIZATION – COMMON STRATEGIES OVERVIEW



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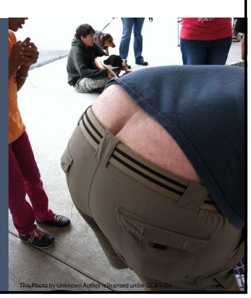
FLEXION RELAXATION

- Well studied and rarely mentioned motor control phenomena
- Flexion relaxation is observed in the lumbar ES at full trunk flexion in the majority of healthy individuals without back pain – Floyd et. al)
- Absence of flexion relaxation is present with LBP but does not clearly resolve after pain has resolved! – Raymond & Lin
- It has also been shown to be absent in sitting for those with LBP! - Callaghan & Dunk

DYNAMIC PRINCIPLES



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MOTOR CONTROL – GLUTES AND EXTENSION PATTERN

The gluteals and the hip extension patterns

- Gluteals are more active in walking with people with LBP and the gluteals fire earlier than the hamstrings – Vogt et al.
- Standing from a flexed position resulted in more gluteal activation for people with LBP - Leinonen et al

Janda's proposed firing order – His findings never were placed under peer review

1. Glute max
2. Hamstrings
3. Contralateral erector spinae
4. Ipsilateral erector spinae

Testing the prone hip extension test

- In normal/healthy pain free individuals – Study repeated in 6 studies (Lehman, Pierce & Lee, Vogt et al., Oh et al., Sokamoto et al, Chance-Larson et al, Lewis et al)
  - In all cases, the glutes fired last and everything else activate in random order

DYNAMIC PRINCIPLES

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FINE – BUT DON'T THESE EXERCISES CHANGE MOVEMENT PATTERNS?

DYNAMIC PRINCIPLES

- **8-week of specific local, high load, or general exercise on abdominal activation pattern in cLBP**
  - *No difference* between any group at 8 weeks as measure by ultrasound imaging
- **5-week core/hip musculature program for LBP**
  - *No change* in activity of musculature of lumbar/hip musculature other than increase in delay of glutes with flexion by EMG
- **6-week program in hip strength and "motor control" exercises**
  - *No change in valgus* – but decreases in pain and increases strength

…. The problem with all motor control studies

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MOTOR CONTROL & MUSCLE ACTIVATION PATTERNS – CORNERSTONE STUDY

If you record muscle activation patterns of 80 different people biking and walking, how many different muscle activation patterns with pedaling and stepping will you find?

- 80 different patterns that are unique to each individual!

If you take 53 of those people and have them do the same thing the next day, what will you see?

- They're different again the next day but are still unique to that individual!

CONTEXT IS KING FOR MOTOR CONTROL!

DYNAMIC PRINCIPLES

Individuals have unique muscle activation signatures a
revealed during gait and pedaling – Vogel et al. 20

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"MOTOR CONTROL CANNOT BE UNDERSTOOD IN TERMS OF MUSCLE-SPECIFIC MOTOR PROGRAMS"

Theo Mulder – 1991

A Process-Oriented Model of Human Motor Behavior: Toward a Theory-Based Rehabilitation Approach

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MOVEMENT IS CONTEXT BASED

You cannot screen for movement dysfunction

- When you screen for movement, perceived dysfunctions are immediately corrected once the participant is informed of the goal – Frost et al.
- Simply watching the test and the objective allows the participant to meet the demands of a test – Bryson et al.

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CHANGING GAIT

Want to change a runner's gait?

- Hip strengthening and "motor control exercises" won't do it! – (Willy & Davis, 2011)
- Give them a context (sound and visual) without any specific details – The movement changes!
  - Visual biofeedback in the form of vertical ground reaction force signal from the treadmill 163 was displayed on the monitor in front. Participants were asked to "run softer" so that the 164 amplitude of vertical impact peak would be reduced or even diminished – 8 sessions over 2 weeks
  - Decreased vertical loading and notable kinematic changes

DYNAMIC PRINCIPLES

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FEAR (CONSCIOUS OR OTHERWISE) AND MOTOR CONTROL

Human Fear-related motor neurocircuitry – (Butler, et l.)
- In normal healthy individuals, fear inducing contexts profoundly impaired primary motor context
- Anxiety, depression… Scary words?

People fearful of pain will change motor control after being exposed to standard DOMs protocol(Trost et al.)
- Reduced willingness to flex – what if this does not revert?

What if no conscious fear is recognized?
- Acute/Sub-acute LBP still demonstrates protective behavior – human organism protects against potential threat regardless of conscious recognition (Wong et al.)

73

EMOTIONS AND MOVEMENT

Goal oriented movement is significantly influenced by emotions – Esteves et al.

Excessive isometric contraction at rest associated with emotion – Coombes et al.

Dynamic posture changes occur relative to emotions – Hillman et al.

Gait is affected by emotional state ***in healthy individuals*** - Gélat et al.

Emotions influence proprioceptive coding of movement – Ackerly et al.

Thought: Job satisfaction is number 1 predictor of work injury and return to work after injury – ***NOT JUST BECAUSE OF MOOD***
- You move different when you are angry, depressed, anxious – your very emotions may increase physical strain to your body!

74

IDEOMOTION

No such thing as an isolated movement, thought, or emotion!

Ideomotion
- " third category of nonconscious, instinctive behavior, which also included excitomotor (breathing and swallowing) and sensorimotor (startle reactions) activity. "

Generally: movement that occurs as a result of cognitive/mental activity without conscious intent
- Examples: facial muscles with emotions, hand motions with talking, movement related to discomfort
- It is hard to suppress your body language from your thinking and emotions!
- Botox of the face which limits these facial effects reduces your ability to feel the emotions related to these movements

- Applications to clinic
  - MMT Testing – If tester perceives the test will be weak, via ideomotor behavior they may change the amount of force they use – Hence the validity problems of MMT
  - Palpatory tests such as positional sense
    - If we believe we corrected it, unconsciously our hands may be placed in a way that appears to us visually that the "Fault was corrected" – See the results of SIJ manip study – Everyone felt they corrected but imaging showed otherwise!
  - Barret Dorko Proposes that ideomotor movement may occur to reduce mechanical deformation of the nervous system

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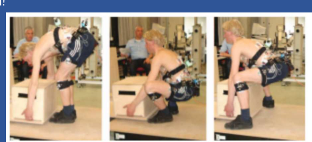
BIOMECHANICS

76

IS IT POSSIBLE TO HAVE A "NEUTRAL SPINE"?

Observations of trained weightlifters
- 40-50 degrees of flexion occurs during efforts of "maintaining neutral" (Kingma, et al, Mckean et al, McGill et al.))
- Which has least amount of lumbar flexion (more neutral?)
- "Stoop" for the win!



Kingma et al 2010

77

The attempts to recover

- Primary care – X-ray & MRI
- Chiropractor – X-ray
- Physical Therapy x 3
  - MDT/Mckenzie
  - Different core exercises are every PT – *Each one telling the other exercises were either wrong or not enough*
  - Regional interdependence manual therapy/MET/manipulation/self mobs
  - Posture education and emphasis on "protecting spine" with neutral spine in lifting/bending
- Orthopedic Spine Surgeon – Additional X-Ray & MRI
- Pain Specialty Anesthesiologist
  - ESI x 2
  - RFA x 1
- Self efforts
  - Stretches & mobility work
  - More core
  - Back braces
  - Protect his back from strain

7 Providers!

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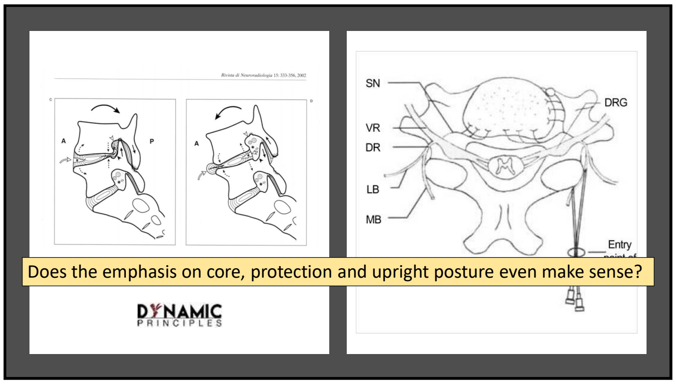
SN
VR
DR
LB
MB
DRG
Entry
Does the emphasis on core, protection and upright posture even make sense?
DYNAMIC PRINCIPLES

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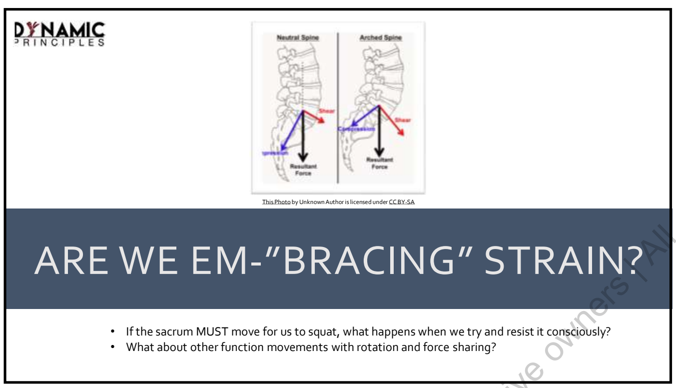
DYNAMIC PRINCIPLES
Neutral Spine
Arched Spine
Shear
Compression
Resultant Force
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ARE WE EM-"BRACING" STRAIN?
• If the sacrum MUST move for us to squat, what happens when we try and resist it consciously?
• What about other function movements with rotation and force sharing?

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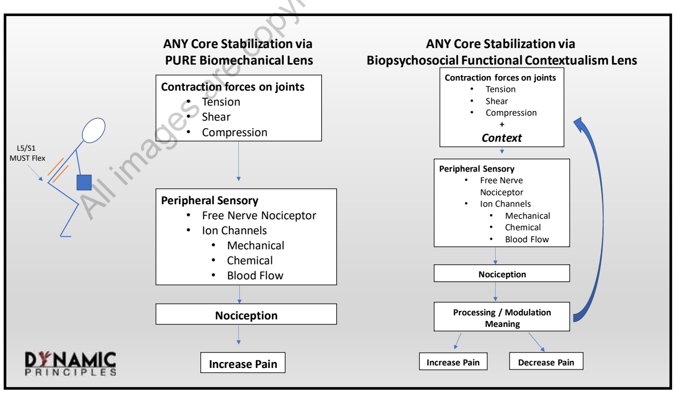
ANY Core Stabilization via PURE Biomechanical Lens
Contraction forces on joints
• Tension
• Shear
• Compression
L5/S1 MUST Flex
Peripheral Sensory
• Free Nerve Nociceptor
• Ion Channels
• Mechanical
• Chemical
• Blood Flow
Nociception
Increase Pain
ANY Core Stabilization via Biopsychosocial Functional Contextualism Lens
Contraction forces on joints
• Tension
• Shear
• Compression
+
Context
Peripheral Sensory
• Free Nerve Nociceptor
• Ion Channels
• Mechanical
• Chemical
• Blood Flow
Nociception
Processing / Modulation Meaning
Increase Pain
Decrease Pain
DYNAMIC PRINCIPLES

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LETTING GO OF STABILITY

How knowledge and behavior change saved me

DYNAMIC PRINCIPLES

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TRADITIONAL BIOMECHANICS AND PFPS

DYNAMIC PRINCIPLES

Chicken or the egg?

- Do we move different because we hurt or do we hurt because we move differently?

Q-angle in patellofemoral pain: relationship with dynamic knee valgus, hip abductor torque, pain and function – Peixoto et al.

"The q-angle did not present any relationship with pain intensity, functional capacity, FPPA, or hip abductor peak torque in the patients with PFPS."

No association between q -angle and foot posture with running-related injuries: a 10 week prospective follow-up study – Ramskov et al.

Is hip muscle weakness a predisposing factor for patellofemoral pain in female novice runners? A prospective study – Thijs et al.

"The findings of this study suggest that isometric hip muscle strength might not be a predisposing factor for the development of PFPS"

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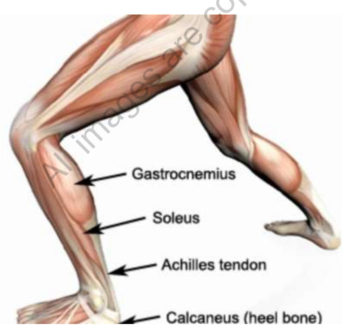

HOW MUCH DOES THE ANKLE INFLUENCE THE KNEE?

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MOBILITY/STABILITY MODELS

- Mobility
- Stability
- "Mostability"
- Dynamic stability
- ?????????????

DYNAMIC PRINCIPLES

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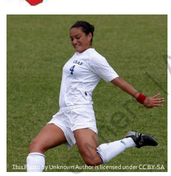

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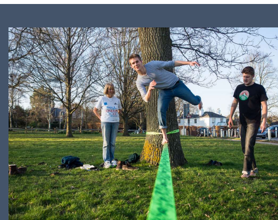
VARIABILITY DOES NOT MEAN RANDOM

Confusion inherent to "instability" is that for something to "remain in place", it requires significant variability to accomplish this behavior, no joints or regions are staying "stable" to accomplish the task of being in one place, otherwise control is lost

- IE: Balance on a slack line has large variable movements while still remaining on the slack line (Stergiou, et al)



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DYNAMIC PRINCIPLES

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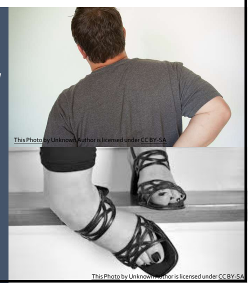
MOVEMENT STABILITY VS VARIABILITY IN INJURY RISK

- Athletes at greatest risk for injury have the least variability– They have the most stable movement patterns! - Hamil, et al.
- Low adaptability with less variability predicts injury – Glascow, et al.
  - Think about the importance of improving load capacity!
- Too great of a variability may also be associated with injury



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WHEN PAIN GOES AWAY, DOES VARIABILITY RETURN?

Pain associated movement changes - Moseley & Hodges
- When painful stimuli introduced (capsaicin), move variability decreased (it was done more the same)
- When subjects recovered from pain, the movement STILL lacked variability

DOMS of back musculature in normal healthy people with fear believes reduces flexion options in movement patterns after the DOMS has resolved

Ongoing perception of threat influences movement even in the absence of pain
- I sometimes call this "post-antalgic patterning"
- It is probably simpler to say we have movement protection patterns which don't change until awareness and new options are introduced back into the system

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BREAK

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Awareness

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DYNAMIC PRINCIPLES

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Awareness

- Sensory
  - Sensations and perceptions
- Cognitive
  - Self
    - I / You
    - Here / There
    - Now / Then
  - Thoughts / Beliefs
  - Values
  - History
- Emotions

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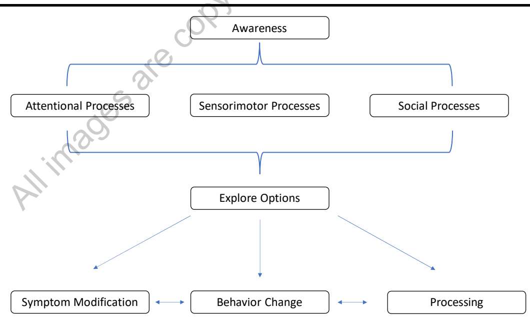

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SENSORY AWARENESS

ATTRACTION rather than DISTRACTION

94

The textbook stuff missed in school

95

SENSORY DISCRIMINATION

DISCRIMINATION not DESENSITIZATION

- Tactile discrimination, but not tactile stimulation alone, reduces chronic limb pain. – Moseley et al.

DYNAMIC PRINCIPLES

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TACTILE ACUITY

NOT A NEW IDEA – Cohen et al. 1983!!

Systematic Review – Catley et al.
- Tactile acuity is altered in people with non-neuropathic chronic pain conditions.
- Tactile acuity is worse at the site of pain than at contralateral pain-free regions.
- No significant associations between tactile acuity and pain intensity or duration were identified

2-Point discrimination most studied method of measuring tactile acuity – Mancini et. al
- Skin temperature, body hair, patient cooperation and fatigue, clinician concentration and application pressure to influence tactile
- Lumbar tactile acuity is equal side to side in pain free individuals – Wand et al.
- Standard error is between 3-5mm
- Anything greater than 13mm horizontal or 17mm vertical can be assumed a true difference exists

Lumbar pain free vs. pain norms – Adamczyk et al.
- 50mm +/- 11.74mm
- Similar range for upper trapezius

DYNAMIC PRINCIPLES

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DYNAMIC PRINCIPLES

LOCALIZATION

Sensory discrimination and cLBP -Louw et al.

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The not-so-simple stuff

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SENSING SELF

Interoception – "Distinct cortical image of homeostatic afferent activity that reflects all components of the physiological conditions of all tissues of the body"

- A poor sense of self could be a vulnerability to mental and physical illness - Barrett & Simmons

Proprioception – Sense of the position of the body/body segments originating through input of muscles and joints

Exteroception – Exteroceptors include eyes, ears, skin

Vestibular Input – Inner ear (semicircular canal)

- Side Note: "patients with vestibular disorders have been reported to experience other personality changes that suggest that vestibular sensation is implicated in the sense of self" – Smith & Darlinton

DYNAMIC PRINCIPLES

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KINESTHESIA

Diane Jacobs Knowledge Nugget:

- 1. Kinesthesia is to proprioception as pain is to nociception.
- 2. Pain is awareness of (danger signaling perceived as if coming from) the body, top-down.
  - Nociception is sensory input, bottom-up.
- 3. Kinesthesia is awareness of (movement of) the body, top-down.
  - Proprioception is sensory input, bottom-up.
- 4. It is not appropriate to mix up any of these.

DYNAMIC PRINCIPLES

101

HOW WE SEE OURSELVES

The neuroscience of body memory: From the self through the space to the others – Riva

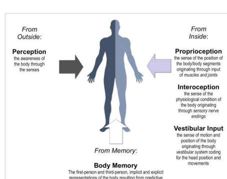
"Our experience of the body is not direct; rather, it is mediated by perceptual information, influenced by internal information, and recalibrated through stored implicit and explicit body representation (body memory)"

"From an evolutionary perspective, the main goal of the body matrix is to allow the self to protect and extend its boundaries at both the homeostatic and psychological levels"

Internally
- Proprioception
- Interoception (and exteroception)
- Vestibular Input

Body Memory
- Predictive multisensory integration

From Outside – term used because our experience is not direct
- Perception



Riva, Giuseppe. "The neuroscience of body memory: from the self through the space to the others." *Cortex* (2017).

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FUNCTIONAL UNDERSTANDING OF OUR APPROACH TO MOVEMENT

103

BIOMECHANICS – RETROSPECTIVE ANALYSIS

- 30+ years of biomechanics research have shown you can't "protect" anything – you just redirect forces elsewhere, the question to ask yourself boils down to:

Where do you want to direct strain, compression, or shear right now?

- There is lays the benefit of variability in a nutshell:
  - Choose what forces you want where and change them as freely and flexibly as possible, so you don't have all the forces target in one area
  - UNLESS there is a functional benefit to that area increasing stress tolerance!

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BIOMECHANICS – RETROSPECTIVE ANALYSIS

Remember your basics
- Tissues grow in response to stress
- Unless you don't get adequate rest or you blow way past their threshold, you are NOT damaging tissues with postures or movement
- Tissues WILL get stronger

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MOTOR CONTROL – DEGREES OF FREEDOM

Degrees of Freedom - Nikolai Bernstein

- Movement variability is dependent on degrees of freedom
- Around 206 bones, 360 joints, and 640 muscles involved in those joint interactions
- Quality of movement
  - Appears more smooth, flowing, and graceful with more degrees of freedom
  - Appears more rigid with less degrees of freedom
- This quality of movement can be perceived intrinsically with conscious attention
- Early childhood motor learning is associated with locking degrees of freedom such as the trunk and the leg to achieve standing
  - This is essentially "the hip hinge"
  - These are rigid, as motor learning improves, more freedom is given in degrees of freedom and the child looks less like they are "hip hinging"
    - Not to mention body shape and weight changes!! There is no value to "squat like a child", the context as changed since then!

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DEGREES OF FREEDOM IN MOTOR CONTROL - PAIN

When we have increases in nociception from actual or potential injury, nocifensive movement behavior frequently appears to be performed with less degrees of freedom – EG: Withdrawal from touching a hot stove

- With individuals who report LBP – degrees of freedom of the lumbopelvic region also are decreased
  - We automatically start to produce movement that looks like a "hip hinge"
- Similar antalgic patterning after acute ankle sprain and painful shoulders also demonstrates decrease degrees of freedom through the kinetic chain of the peripheral extremities

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DEGREES OF FREEDOM IN MOTOR CONTROL – PAIN - CONTINUED

Limitation of degrees of freedom may come about from increased co-contraction of the muscles surrounding the joints of the region where actual or potential injury is present

- Increase co-contraction increases metabolic demands and activity
- Increased shear and compressive forces
- Impairment to muscular neurovascular supply
- Loads introduced through system are focused on fewer regions increasing tissue tensile stress to only a few structures
  - Susceptibility for exceed tissue tolerance to strain is increased
- While these are ideal circumstances for tissue hypertrophy and building new tissue

What may the long-term possible implications of these behaviors relative to the potential for a future painful experience and/or possible tissue injury?

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INCREASING DEGREES OF FREEDOM & MOVEMENT VARIABILITY

- Childhood, with its natural curiosity to explore in environments naturally drives children to explore increased degrees of freedom in which higher levels of motor control could be performed.
- For many environmental, biological, psychological, sociologic ,and culture reasons, degrees of freedom become increasing limited through the span of adulthood.
- It is unlikely that without conscious awareness and meaningful action that degrees of freedom would increase.
- Many of our "Specific exercises" may increase variability even if we didn't plan for it when we prescribed it:
  - Pelvic tilt exercises "accidently" increases degrees of freedom and regional awareness relative to lumbopelvic and thoracolumbar regions.
  - Rowing exercises "accidently" increase degrees of freedom and regional awareness for glenohumeral and scapulothoracic regions
  - Cervical "motor control exercises" "accidently" increase degrees of freedom, variability, and regional awareness relative to cervicothoracic and craniocervical regions.
- Do we have to be specific?
  - General exercise in the same regions result in the same outcomes as specific exercises.
- Does it have to be physical exercise?
  - Exercise alone does not outperform cognitive and/or emotional oriented interventions for pain.

Perhaps these outcomes have nothing to do with any exercise other than the increase in awareness and meaningful action?

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MOVEMENT WITH ATTENTION AND FINDING EASE

- Functional Contextual Process based approach to movement.
- Prescriptive Exercise likely works indirectly on processes but are limited to short/medium term.
- Let alone prescriptive exercise adherence is low after discharge.

110

MOVEMENT, THINKING, EMOTIONS

When you assess movement – You assess the role of emotions, including anxiety and depression, in movement expression!

- If we know our words matter and have gotten us into trouble, in particular with pain, how is this any different with talking about and prescribing movement?
  - Not a single well controlled study published has shown benefits of specific exercise over general exercise.
  - Specific exercises do not change muscle activation patterns or kinematics in functional activities – You can learn to better generally engage certain muscles in certain contexts for the purpose of research, but it has no meaning in function.
  - Any exercise that creates an isometric (some evidence for concentric as well) muscle contraction has the potential produce ***isometric descending modulation*** ("pain relief")
    - When you brace your core or aim to "target your tVA", the pain relief is likely predominantly related to this phenomena, the actually biomechanics involved in these exercises independent of isometric descending modulation would likely "provoke" increased nociception via sheering and compressive forced on sensitive structures of the spine if the system believed it a threat. In other words, to willingly "stabilize" your spine is more likely to increase pain if not for ***isometric descending modulation.***

111

LIMITATIONS TO ACKNOWLEDGE

- We recognize the limitations of conscious awareness on high level skill performance and impairment of performance associated with internal attention vs external attention.
- We propose to counter this short-term impairment with informing the client of this risk comes with the opportunity for new motor learning when external cues are again made primary during coaching of high-level skill.

112

PRACTICAL NUGGETS

- 2-Point Discrimination is an awareness process
- Sensorimotor testing is an awareness process

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FINAL NOTE BEFORE LAB

The concepts come down to changing the things we know we can change, knowing the things you can't change, and keeping in mind the things will change with time.

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MEANINGFUL ACTION

Finding Ease and Movement with Attention Lab

&

Reconciling “Exercises”

115

Science and Manual Therapy

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DYNAMIC PRINCIPLES

1

MANUAL THERAPY

DYNAMIC PRINCIPLES

2

Definition of Manual Therapy: No Consensus of definition, who you subscribe to will give you a different definition when compared to another organization

We can all agree that touch of the body can be a form of therapeutic treatment

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DYNAMIC PRINCIPLES

3

STRETCHING

DYNAMIC PRINCIPLES

4

DEFINITIONS

Static Stretching (SS) can be defined as involving a slow, gradual, and controlled elongation of a muscle, in which the end range is held passively for a designated period of time

Dynamic stretching (DS) can be defined as a functional stretching exercise that utilizes sport-specific movements to prepare the body for activity

Other stretching - PNF, etc.

DYNAMIC PRINCIPLES

5

STATIC STRETCHING

- **Studies have shown that acute SS:**
  - Reduced force production
  - Reduced sprint performance
  - Decreased depth-jump performance, vertical jump height, and long jump distance
  - Decreased balance, reaction, and movement time
  - SS also has not been shown to reduce the risk of injury

DYNAMIC PRINCIPLES

6

DYNAMIC STRETCHING

Fair to even call stretching? Just an active warm-up

- **Research on the acute use of DS has demonstrated:**
  - Improvements in sprinting performance
  - Leg extension power
  - Closed skill agility performance
  - Improved performance for children when executing the long jump

DYNAMIC PRINCIPLES

7

STATIC STRETCHING AND INJURY

Stretching Prior to Exercise

- Multiple studies and reviews have confirmed static stretching prior to exercise does not reduce the risk of injury. (Thatcher et al.)

Long Term Stretching on injury reduction

- A single study demonstrates a very small trend (clinically insignificant) long term decrease in musculotendinous injury with regular long term stretching (Amako et al.)
- …However, during the first month, the static stretching group had a higher incident of injury.

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DYNAMIC PRINCIPLES

8

CONTRACTURE FUNDAMENTAL CONCEPTS

- Classically and still day to day, contracture is treated as a biomechanical problem. Which it may ultimately become..
- However, contracture or shortening of tissue is defined neuroimmunologic response to either a local or systematic perceived threat by the nervous system. (Katalinic et. Al)
- If contractures neuroimmunologic responses rather than purely biomechanical problems, what is the evidence for stretching a contracture?

DYNAMIC PRINCIPLES

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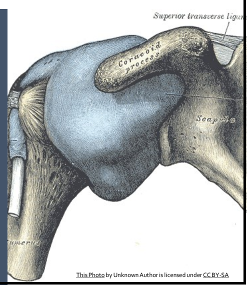
CONTRACTURE AND STRETCHING

DYNAMIC PRINCIPLES

Cochrane Review

- There is high quality evidence to indicate that stretch does not have clinically important short or long-term effects on joint mobility in people with neurological conditions
- There are no important immediate effects of stretch on joint mobility in people with frailty, ankle fractures or total knee replacements, or people receiving radiation therapy following breast cancer.
- There is no evidence of the short-term effects of stretch on joint mobility in people with non-neurological conditions.
- The long-term effects of stretch in people with ankle fractures or total knee replacement are small and clinically unimportant.



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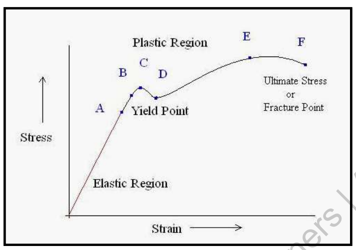
10

CAN WE MECHANICALLY LENGTHEN TISSUE WITH STRETCHING?

- No ROM relevant mechanical changes in tissue length have been shown in human or animal studies related to stretches in duration of up to an hour
- Stress strain curve misleading and minimally applicable to ROM



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DYNAMIC PRINCIPLES

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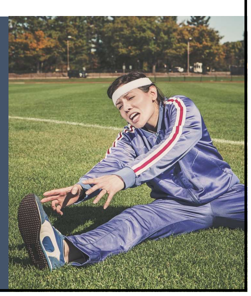
LONG TERM STRETCHING ROM INFLUENCE

Can chronic stretching change the muscle-tendon mechanical properties? – Freitis et al. 2017

- "Stretching interventions with 3- to 8-week duration do not seem to change either the muscle or the tendon properties, although it increases the extensibility and tolerance to a greater tensile force. Adaptations to chronic stretching protocols shorter than 8 weeks seem to mostly occur at a sensory level."



12

STRETCH TOLERANCE

- Central and peripheral adaptations to nocioceptive input (Wepler & Magnusson, Konrad & Tilp, Koliaskina, et al.)
- We tolerate a greater degree of stretch immediately and over time, this increases our ROM
- Interesting demonstration of central modulation: Stretching one side also immediately and in long term improves the other (Nelson et al.)
- See the importance of understanding nociception and the Neuromatrix??

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DYNAMIC PRINCIPLES

13

ANTALGIA – ACUTE AND CHRONIC

Revisiting some MOVEMENT concepts:

- During physiologic cascade of events which occurs to address real or potential injury, the nervous system, both central and peripheral, protects the region through numerous responses including localized guarding or splinting.
- This guarding process involves contractile activation of muscle AND the CONTRACTILE activation of fascia, joint capsules, ligaments
- As a result, kinematics, arthrokinematics, and tissue dynamics may be altered and movement may change. Some of it is subtle, some of it not.

This behavioral state, which includes soft tissue/joint guarding/splinting reduced ROM, appears to stay active long after the tissue has healed and the threat removed

DYNAMIC PRINCIPLES

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Thought:

If you re-imagine range of motion changes as sensorimotor behavior rather than plastic tissue changes, does that limit or open your options clinically?

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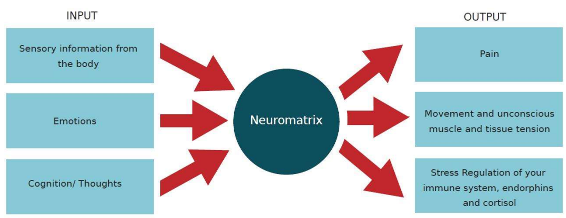

NEUROMATRIX

How many times will I show this picture today?

DYNAMIC PRINCIPLES

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ASSISTED STRETCHES

What is wrong with this picture from a top down perspective?

- Who is in control?
- What about possible threat?
- Could this be why they keep being tight?
- Could the be something above of below that is making this tightness secondary?
- What about their beliefs about their flexibility? "I'm just tight all the time"

DYNAMIC PRINCIPLES

17

HIP FLEXORS

Widely clinically believed to be "tight"

Analysis should include **Thomas test, sidelying assessment, and swing test** to differentiate out clear contributor.

- Femoral nerve can be sensitized by stretch, improving stretch tolerance of the hip flexor should be done with care
- Tight hip flexors don't influence squats!!!!
- Visualization and somatosensory experience options using case example

DYNAMIC PRINCIPLES

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HAMSTRINGS

- Unless someone is a martial artist, dancer, soccer player, or a gymnast- Most need no more than 60 degrees and a small margin beyond that for safety
- Don't need much hamstrings for squatting, one end slackens, the other lengthens
- Sciatic nerve sensitization may decrease stretch tolerance even on slack, it is unlikely we can differentiate out neurodynamics from reduced hamstring flexibility

19

SELF MOBS

- Much of these are based on Brian Mulligan, just expanded or different presentations
- Kelly Starrett:
  - Applaud for putting into hands of the patient/client.
  - However, reinforces faulty body beliefs and risks of increasing sensitization with emphasis of possible overstretching neural structures with quotes like "tear up that hip flexor"

20

FOAM ROLLER GATEWAY DRUG

- Starts soft foam, keep progress to plastic/bumps until using wood or metal materials
- Warning sign? Possibly beginning of a peripheral or central sensitization?

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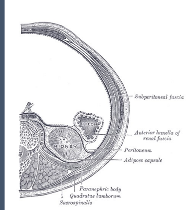
PAIN FACE

Doing a self treatment which results in "Pain face" as Starrett advises. MIGHT benefit in DNIC, but also risk of sensitization, and possibly structure or neural injury in some positions

22

FASCIA

- Still the "new pink" even though over 60 years of age
- Wraps entire body and every organ of the body
- My journey to the brain was via "fascia"
  - Adriaan via the facet joint



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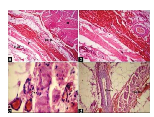

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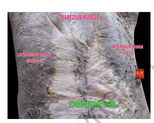

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FROM THE FATHER OF FASCIA

- Tom Myers – Author of Anatomy Trains – The "Bible of Fascia"
- "I am so over the word 'fascia'. I have touted it for 40 years – I was even called the 'Father of Fascia' the other day in New York (it was meant kindly, but…) — now that 'fascia' has become a buzzword and is being used for everything and anything, I am pulling back from it in top-speed reverse. Fascia is important, of course, and folks need to understand its implications for biomechanics, but it is not a panacea, the answer to all questions, and it doesn't do half the things even some of my friends say it does."
- Acknowledgement: *I used to promote the heck out of this book!*

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FASCIA DEFORMATION

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How much can we really do to fascia through the skin?

With exception of dorsum of hands/feet, face, superficial Fascia = 0.5-1.5" thick!!

Research on fascia deformation:

How much force to deform the superficial nasal fascia 1%?

213 pounds!

How much force to deform the IT band 1%?

2,040 pounds!!!

Authors conclude "The fascia lata and plantar fascia require much greater forces for deformation, which are greater than what can be applied in OMM treatments."

You'd think we learned out lesson from stretching…

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OBERS TEST HIGHLIGHT

- **Obers Test**
  - Modified ober's test and ober's test repeated measurement was shown to have good inter-rater reliability 0.73 and excellent intra-rater reliability 0.94 in participants with anterior knee pain.
- **Slight problem**
  - When the IT Band is anatomically transected cadavers, it has no influence of hip adduction in the Ober's test
  - Gluteus minimus and medius and hip capsule had to be transected to change adduction ROM in Ober's test

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QUICK IT-BAND SIDE NOTES

- "We would thus suggest that the ITB cannot create frictional forces by moving forwards and backwards over the epicondyle during flexion and extension of the knee. The perception of movement of the ITB across the epicondyle is an *illusion* because of changing tension in its anterior and posterior fibres. "- Fairclough et al.
- "A clear biomechanical cause for ITBS could not be devised due to the lack of prospective research." -Louw and Deary
- More to come later..

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IT BAND - CONTINUED

- Can't be stretched, rolled, or deformed, period. It is designed to be a piece of steel sheeting to distribute the forces yielded on it
  - From fascia review **2,040 pounds** of tension tangentially to change barely 1%.
- IT SHOULD BE TIGHT!
- Rolling it or deep tissue work first engages the anterior lateral and posterior lateral cutaneous n. distribution, nothing happens to the IT band with more pressure, and depth through the IT band may make contact with the vastus lateralis and biceps femoris (free nerves in vessels, fascia, spindles/gtos)
- Stop caring about the IT band, it's a big boy, it can take care of itself.

DYNAMIC PRINCIPLES

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DYNAMIC PRINCIPLES

FASCIAL FUZZ?

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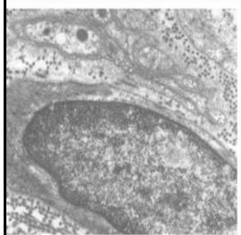
FASCIA – CONTRACTILE?



lectron photomicroscopy of a typical smooth muscle cell within the Fascia cruris. Above
erminal portion of a type IV (unmyelinated) sensory neuron. (Photo reproduced with kind
on of Springer Verlag, first published in Staubesand 1996.)

- Primary purpose is to be a "firewall" between tissues
- Fascia is not entirely inert
- It has a contractile component to it – Smooth muscle cells – the basis of contracture and healing. (Schleip)
- **Smooth muscle cells** – Unconsciously influenced
- Histamine triggered contraction?
- Also sometimes contains true skeletal muscle – Face/Neck Scrotum (Benjamin)
- Important to realize these are EXTREMELY small changes and likely serve a primary role in development of contracture

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SKIN AND FASCIA FRICTION

- Skin slides over fascia and is only limited by skin ligaments which are broadly spread out
- **DEMONSTRATION**
- Interaction between skin and fascia is frictionless other than skin ligament holding relative positions - Bereznick et al.
- Based on this properties it is nearly impossible to be very localized to structures on the skin with manual therapy techniques throughout the body
- Taking up slack to direct the rotation thrust at the thoracic at a specific joint is impossible, similar with craniosacral techniques, you only can direct perpendicular forces.
- What are the odds that "frictioning" with either your hands or tools result in "frictioning" the surface below, or deforming deeper layers if the surfaces are friction free?

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THE SCAR TISSUE DILEMMA

- No study has shown a mobilization, manipulation change a joint or "break an adhesion"
- Skin/fascia interface is frictionless so only skin scar tissue can be interacted with soft tissue techniques
  - "The evidence for the use of scar massage is weak, regimens used are varied, and outcomes measured are neither standardized nor reliably objective, although its efficacy appears to be greater in postsurgical scars than traumatic or postburn scars. Although scar massage is anecdotally effective, there is scarce scientific data in the literature to support it." – Shin and Bordeaux
- No soft tissue or stretching technique changes contracture in any meaningful way – Cochrane
- Heavy fibrosis and MRI defined poor healing of hamstring or achilles tears in high level soccer players do not influence pain, performance, or re-injury over 3 years time – Reurink et al.

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CROSS FRICTION EVIDENCE

- Cochrane Review
  - Inadequate controls of research, mostly case studies, minimal RCTs, lacking basic physiologic evidence
  - Available evidence does not show any benefit over controls
- Questions of logical conclusion – After watching seeing density and layers skin, fascia, prior to tendon interface and evidence of frictional skin interface, what are we really doing?
- Crossfrictioning using Graston protocol decrease perception of function and significant increase in pain for up to 72 hours after administration – Vardiman et al.

DYNAMIC PRINCIPLES

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BREAKING UP SCAR TISSUE?

Does it even make sense to break up 'scar tissue'?

- If you break up any tissue, you are creating mild injury – you may have bleeding and you will likely have an inflammatory response
- An inflammatory response is likely going to increase afferent impulses which may be painful and may inspire motor control to be more protective
  - ***You also just create a scenario for increasing chemical nociceptive sensitivity!!***
- To "restart" the healing process by introducing trauma (hands/tools/injections) assumes we know that the phase the healing ended at was the wrong phase, or that it has stopped remodeling which could take years
  - How do we know it didn't end at the perfect time for maximal functional return and now you are just messing with it again?
- There is no indication the scar will not reform the same way it did the first time
- You have no way of knowing whether the scar influenced movement or structures in any meaningful way
- Active muscle contraction will do far more for arrangement of collagen fibers

DYNAMIC PRINCIPLES

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MY ARGUMENT TO FORGET SCAR TISSUE

My argument to forget scar tissue:

- Skin is frictionless – impossible to target anything below the skin with soft tissue techniques and manipulative techniques require significant force the is likely intolerable to conscious person – Plus manipulation under anesthesia has poor outcomes
- It may worsen pain and create protective motor control behavior
- Aggressive techniques can worsen performance up to 72 hours and NO meaningful histologic changes! (See IASTM study)
- Your efforts to restart the healing process could be doing exactly the opposite and may negatively impacted perfectly functioning scar tissue health
- It is a waste of time compared to finding another way to build up **loading capacity!**

I treat many patients with large amounts of hardware and visible clumps of scar tissue throughout their body restore mobility, function, and decrease pain without any attention to the scars

DYNAMIC PRINCIPLES

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STAGING THE COMPREHENSIVE MODEL

"Just because a technique is directed at a structure, relieves pain, does not mean this structure is the source of the problem" – Louis Gifford

- I would add, nor is the technique actually influencing the structure, if interaction with the structure even occurs! Skin/Fascia dilemma..

- Most of us think about our targets for manual therapy as muscles, fascia, and joints.
- Your intervention began when your patient/client first meets you, and the second you touch their skin, you've setup a cascade of neurophysiologic events LONG before you have enough pressure to contact anything else

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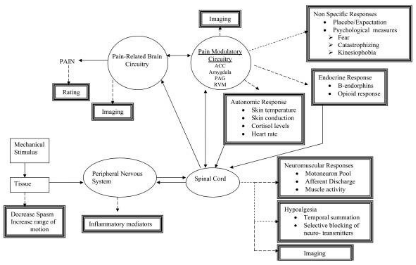

COMPREHENSIVE MODEL – BIALOSKY, ET AL.

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LEDERMAN – MOVING BEYOND STRUCTURE

- "There is a large body of evidence demonstrating that perceived asymmetry, imbalances or postural deviations are normal biological variations and not pathology. Research in this field has demonstrated that the cause of many common musculoskeletal and pain conditions cannot be explained by biomechanics, structure or even posture."
- "There is a clear message from research that osteopathic techniques, in particular passive techniques, have little or no effect on tissue adaptation or neuromuscular/motor plasticity. In this area, osteopathic techniques can be used for guidance or to support active movement performed by the patient."
- "The role of osteopathic manual therapy in alleviating symptoms may be associated with touch effects and 'soothe-seeking' behavior"
- "active mobilization of the affected area by the therapist can provide implicit reassurance that movement is safe. Taken together, all these factors can support recovery; particularly for alleviation of symptoms and pain"

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NEURO-ENDO-IMMUNE

The neurophysiologic mechanisms of manual therapy have been the most closely examined

Cannot rule out endocrine and immune

Immune and endocrine signaling molecules and biology are important communication systems via HPA

DYNAMIC PRINCIPLES

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NEUROPHYSIOLOGIC CATEGORIES

Neurodynamics
- Utilizing the biomechanical and physiologic properties of the physical human nervous system as an assessment and therapeutic intervention

Dermoneuromodulation – Diane Jacobs - 2005
- FRAMEWORK – NOT TECHNIQUE
- Using sensory input to the skin in a non-noxious manner (no discomfort - ideally ease) on, or near treatment target to transmit sensory impulse via spinothalamic (no spine interneuron interference) and result in descending modulation of nocioception and decreased local and regional tone/tension (release sensation) – "Yes-i-ception"

Diffuse Noxious Inhibitory Control (DNIC)
- Using a noxious (uncomfortable) stimulus away from treatment target area to result in both ascending (spine/DRG) and descending (brain) modulation to decrease nocioception in regional and local (Also contralateral) area. Diffuse opiate release – "Hurts so good!"

Contextual Clinician Somatosensory Interaction (CCSI)
- Context prioritized interaction with multiple levels of sensory input including perception of depth and deeper proprioception from clinician pressure and kinesthetic sense via guidance.

DYNAMIC PRINCIPLES

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DNIC – DIFFUSE NOXIOUS INHIBITORY CONTROL

The "Hurts so good" Phenomena
- Trigger Points – Pressure or Dry Needling
- Deep Tissue
- Cross friction
- Foam roll/tennis ball
- Rolfing
- Counter-irritants – Icy hot etc.
- Cupping –Can be done non-painfully!!
- Painful MFR, etc.

Miracle "resets" can and do happen for multiple reasons – but typically short lived..

Warning on continued or progressing in intensity to create the effect – Risk of sensitization??

DYNAMIC PRINCIPLES

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THOUGHTS, ATTENTION, FOCUS

Combination of internal and external
Your manual contacts will maximally benefit from their attention

Two way Street
If you are distracted, distressed: Your interventions will likely be less effective

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BODY MAPS

Somatosensory cortex - Homunculus

Plastic and adaptable to an individual's function
- EG: violinist much large finger presentation

Manual therapy brings awareness to areas that may have been misinterpreted or poorly integrated in homunculus

"Painting the area for the somatosensory cortex"
- 2-Point Discrimination – tactile acuity improvements with IASTM –Ge et al.

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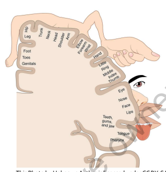

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WHAT CHANGES OCCUR WITH MANUAL THERAPY?

Acute ROM improvements

Neurodynamic changes

Regional ROM changes

Acute perceived pain improvements

Spinal cord related changes

Brain wide cool activity and change – This is really awesome stuff

Possible immune responses – still early – remember can separate the nervous system from the immune or endocrine system!

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RETHINKING MANUAL THERAPY FOR BIOMECHANICS

- Our findings, tight, short, long, weak, strong, posture, and biomechanics have not been found to well correlated to pain.
- Movement inefficiencies in and of themselves do no cause pain
- However, perceived threat can develop from increased stress on the body, possibly even increase nociception
- Reducing threat whether real, or perceived, may help with improving movement and motor control
- Increased confidence and ease in movement may make help decrease the pain experience and help the individual a long their path to recovery
- Decreased local and global tension may increase the freedom and ease of nerve movement, which may decrease anoxia and neuromechanical stress to the nerves and reduce nociception (bottoms up contribution)

DYNAMIC PRINCIPLES

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MANUAL THERAPY AND TISSUE HEALING

- Many manual therapy philosophies emphasize the concept of enhancing healing
- First made popular by Cyriax through cross frictioning
- Now extremely common concept with IASTM such as Graston, Astym, etc. (more on this later)
- Case studies of improving neurodynamics resulting in healing of delayed healing wounds, but this is an indirect effect and no controlled studies
- To date, no manual therapy intervention has had any meaningful influence on tissue healing.
- Don't need healing for people to get better quickly!
- *Keep in mind this requires clinical reasoning, we know plenty of athletes we make feel better quickly but tissues are still healing and need time before RTP!*

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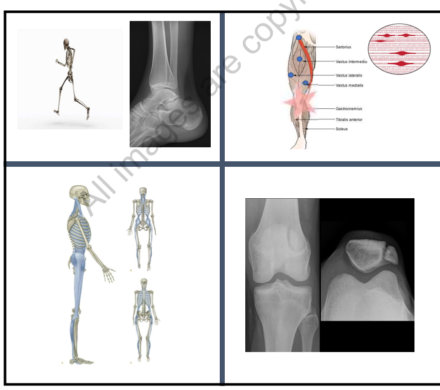

KNEE PAIN – THE JOURNEY

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SOME KNEE PAIN STRATEGIES THAT "WORKED"

DYNAMIC PRINCIPLES

- Soft tissue
  - "Fascial chains", "trigger points"
  - Direct, Indirect – MFR, IASTM, ART, ABCDEFGHI..
- Manipulate/mobilize the talus and the SIJ/Lumbar spine
- Patellofemoral and Patellar mobilization
- Hip and core strengthening
- "VMO"
- Control the knee valgus, tibial IR, forefoot vs rear foot, pelvic tilt
- Foot orthosis
- Taping

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WHAT HAPPENS WHEN YOU QUESTION WHAT WORKS?

50

I LOST A LOT OF SLEEP

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PALPATION

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VALIDITY/RELIABILITY OF ANKLE FOOT PALPATION

Review of physical exam of foot/ankle – Wrobel & Armstrong
- AROM/PROM , talocrural/subtalar/cubonavicular/1st ray mobility
  - Consistently UNRELIABLE and poor agreement between physical therapists, athletic trainers, and podiatrists

Hindfoot Assessment – Keenan & Bach
- "Clinicians taking static measurements demonstrated large errors that do not reflect the precision that has been assumed in clinical theory using these measurements. The availability of static assessments did not improve dynamic assessment. This poor reliability calls into question the importance placed on static and dynamic measurements of the hindfoot in clinical decision-making"

Subtalar Joint Measures – Elveru et al.
- "This report critically reviews methods used to measure STJN position and STJ PROM. Standardized methods for taking these measurements, which have been clinically tested and appear to be theoretically sound, are presented. Although these methods are based on anatomical considerations, their reliability is less than optimal. "

Subtalar Neutral - Harradine et al.
- If It Doesn't Work, Why Do We Still Do It? The Continuing Use of Subtalar Joint Neutral Theory in the Face of Overpowering Critical Research
- "The theory's core concepts still underpin a common approach to musculoskeletal assessment of the foot, as well as the consequent design of foot orthoses. The available literature continues to point to Dr Root's theory as the most prevalently utilized. Concurrently, the worth of this theory has been challenged due to its poor reliability and limited external validity."

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JOINTS

- **Cervical through L5 Systematic Review – Seffinger et al.**
  - Pain Provocation inter/intra-rater reliability – 64%
  - Regional but not segmental motion – 58%
  - Soft tissues – 0%!!
  - Examiner experience and training did not influence palpation ability
- **Lumbar Static Palpation Systematic Review – Haneline & Young**
  - Pain Provocation – pretty good inter/intra-rater
  - Landmarks – none to fair – fair studies did not meet acceptable quality studies
- **Pelvis**
  - SIJ – PSIS/ASIS/Leg Length/Torsion – Stoval & Haneline & Young
    - ***No inter or intra-rater reliability***

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JOINTS CONTINUED

- Static and dynamic imaging has show no change in positions/alignment after delivery of any manual therapy technique – Tullberg et al., Hsieh et al.
- Precision of perceived region of delivery of force with manipulation is +/- 3 levels based on sound and imaging assessments – Dunning et al.
- Provocation testing may be reliable but it is poor for identifying pathology
  - ***Think about how nociception works and this make sense!***

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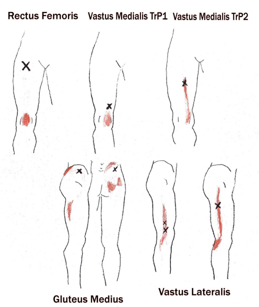

WHAT ABOUT THESE?

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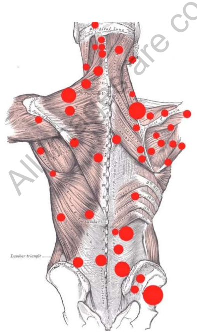

TRIGGER POINTS – WHERE?

- In 1992, 4 myofascial pain experts, including Dr. David Simons of "Travell and Simons" brought in to identify trigger points in patients with myofascial pain, fibromyalgia, and a control with no pain condition or symptoms (Wolfe, et al.)
  - Results <18% agreement in identifying tender spots, let alone whether they were identified as active or passive trigger points.
- **Delphi Study (Fernández-de-las-Peñas C, and Dommerholt J. – 2017)**
  - There was no agreement that the anatomical locations of TrPs coincided with the specific locations mapped (and marked with an X) as set out in the Trigger Point Manual [7]. Furthermore, the majority of experts did not support the idea of a distinct referred pain pattern from TrPs present in any given muscle.

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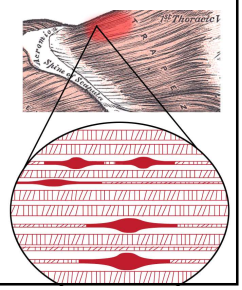
TRIGGER POINTS – WHERE?

- If the creators and most highly trained can't find them, what are we pushing on, stretching, or sticking needles in?
- Pressing (or sticking needles in them) on sore spots and making them hurt more feels better for some people but the process is likely non-specific through diffuse noxious inhibitory control mechanisms (DNIC) – Covered later



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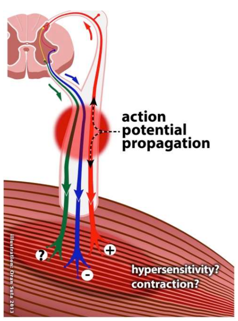

ALTERNATIVE EXPLANATION TO "SORE SPOTS" THAT REFER

- "Pain of peripheral nerve origin can be present without neurological deficit and with normal findings on conventional electrodiagnostic examination. In contrast to the theory of MPS, which considers the TrPs to be sites of primary hyperalgesia, this article argues that all MPS phenomena are better explained as secondary hyperalgesia of peripheral neural origin." – Quintner & Cohen

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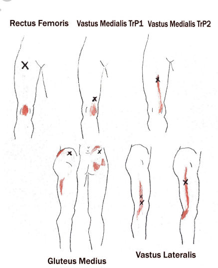

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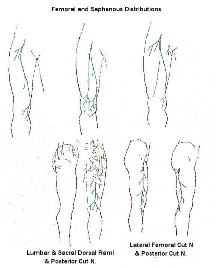

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DYNAMIC PRINCIPLES

SORE SPOTS AREN'T SORE AT THE SPOT

Reminder regarding the error of the Cartesian model

- "Trigger points" (read local protection/guarding behavior) in infraspinatus demonstrates increased motor end plate and EMG activity and pressure on area results local and referred pain and reduce pain pressure thresholds
- Botox injected in spot
- Decrease motor end plate and EMG activity
- No change in pain or pain pressure thresholds

-Qerama, et al.

REMINDER NOCICEPTION DOES NOT EQUAL PAIN!

- The term pain should be reserved to conscious reports and coordinated responses
- Nociception should refer to, ***mostly unconscious, mechanisms that minimize injuries***
  - ***READ PROTECTION/GUARDING BEHAVIOR***
- The relationship between nociception and pain are variable and unpredictable

- Apkarian - 2018

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DYNAMIC PRINCIPLES

NEEDLING: IS THERE A POINT?

JOSPT – Dommerholt, et al:

From a research perspective, many questions remain.

"Is DN more effective than other treatment options? Does DN induce clinically meaningful changes?"

- DN vs. Non-Thrust Mobilization – No Difference
- DN vs Manual Pressure – No difference
- Superficial vs. Deep needling – No difference

JOSPT – Clinical Practice Guideline for Patellofemoral Knee Pain

- Level A – Strong Evidence based on Level I Studies
- Recommendations "Clinicians should not use dry needling for the treatment of individuals with PFP."

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WHAT ABOUT THOSE ACUPUNCTURE POINTS?

Accuracy and Precision in Acupuncture Point Location: A Critical Systematic Review – 2019 - Godson & Wardle

- "Considerable variation in localization of acupoints was reported among qualified medical acupuncturists. Variation in point location among qualified non-medical acupuncturists is unknown due to lack of any identified study"
- "The degree of variance in point localization among practitioners is sufficient to raise concerns regarding safety and efficacy of treatment. A number of acupuncture points lie in close proximity to arteries and other structures prone to damage by needling"

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WHAT ABOUT THOSE ACUPUNCTURE POINTS?

A randomized trial to assess the immediate impact of acupuncture on quantitative sensory testing, pain, and functional status – November 2019 – Chen et al.

- Healthy subjects were included to control for a possible effect of acupuncture on baseline QST changes. Study participants received 6 sessions (twice weekly) of true acupuncture, sham acupuncture, or no acupuncture treatment (routine care).
- A total of 204 participants were analyzed. We found no QST profile changes among 3 groups (P = 0.533 and P = 0.549, likelihood ratio tests) in either healthy or chronic pain participants.
- Both "real" and "sham" were better than routine care

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IS ACUPUNCTURE CENTURIES OLD?

"Based on archival work and fieldwork-based research, Taylor (2005) has since much substantiated this argument that the government of the People's Republic of China (Mao's Great Leap forward) initiated the establishment of TCM in the 1950s. Yet recent developments suggest distinguishing between TCM as a nationalistic project, an 'invented tradition', from the 1950s–1980s, and Chinese medicine and pharmaco-therapy (CMP), an 'alternative modernity' (Knauft 2002) or 'global assemblage' (Collier 2006), in the twenty-first century. In contemporary medical fields, commodified CMP and physiologised acupuncture are the hybridised aspects of Chinese medicine that have gained centre stage"

"Taylor (2005: 117) notes that it was barely coincidence that three innovations in acupuncture were made during the Great Leap Forward. "

- These "innovations" include the use of acupuncture for "pain", prior to this it had more eclectic uses such as spiritual practice..

" Research conducted in certain countries was uniformly favorable to acupuncture; all trials originating in China, Japan, Hong Kong, and Taiwan were positive, as were 10 out of 11 of those published in Russia/USSR. – Vickers et al."

66

NEEDLES AND SENSORY DISCRIMINATION

Acupuncture applied as a sensory discrimination training tool decreases movement-related pain in patients with chronic low back pain more than acupuncture alone: a randomized cross-over experiment – Wand et al.

"Acupuncture may offer specific benefit that is not dependent on precisely where the needles are inserted so much as that the patient attends to where they are inserted. If so, the location of the needles might be better focused on the painful area and the need for penetration of the skin may be mitigated."

DYNAMIC PRINCIPLES

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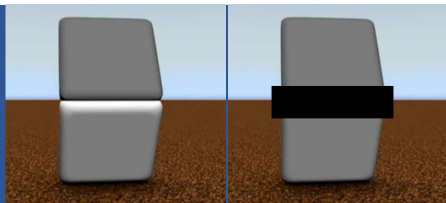
VISUAL PALPATION TESTS



- Do you really trust your eyes?

70

Comparison of Supine and Prone Methods of Leg Length Inequality Assessment

Journal of Chiropractic Medicine – March 2018

- Premise - "Leg length inequality (LLI) assessment is performed by doctors of chiropractic, physical therapists, and doctors of osteopathy for a number of reasons"
- 43 Subjects – 2 Chiropractors
- Conclusion:
- "This study found that supine and prone assessments for leg length inequality were not in agreement. Positioning the patient in the prone position may increase, decrease, reverse, or offset the observed LLI that is seen in the supine position."

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WHAT YOU SEE IS WHAT YOU GET

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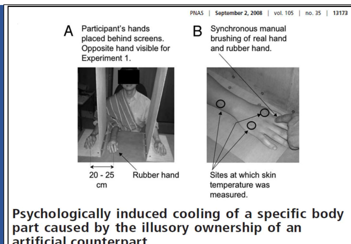
HOW ABOUT YOUR SENSE OF TOUCH?



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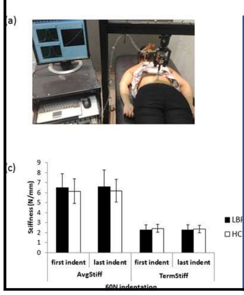
PERCEPTION OF STIFFNESS/TENSION



- What we perceive as tightness/stiffness is a perception as a human
- The perception of stiffness in our body do not match the stiffness of our spine (Stanton et al, 9/3/17)
- Future studies, our palpation?

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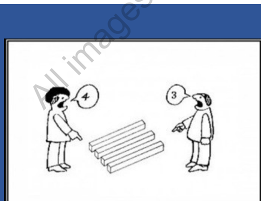
CAN WE PALPATE UNDER THE SKIN?



We have poor accuracy or reliability to palpate ANYTHING under a material, even 1/8th inch cotton!

REGARDLESS OF LEVEL OF TRAINING AND EXPERIENCE – Sabini et al.

75

WHAT ARE WE FEELING DURING TREATMENT?

- **What do we feel during a "release"?**
  - Reduced skeletal and smooth muscle tension – Think OUTPUTS!
    - Human response to real, or perceived threat, unequivocally produces micro (down to a single motor neuron and histamine activation of smooth muscle in fascia) and macro changes (segmental, regional, global). - Hodges
  - Gentle to moderate pressure manual therapy modifies parasympathetic tone, of which vasodilation occurs via relaxation of smooth muscle of the vasculature (Cottingham et al. & Diego & Field)
  - Fluids under tissues migrating around in their space
  - Palpatory pareidolia?

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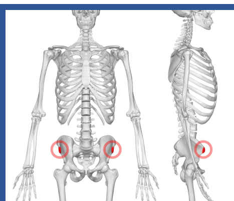
DON'T MAKE THE PROBLEM WORSE THAN IT IS



- Imagine the body threatened in region
- How would it hold itself?
- What would the tissue and joint qualities present?

If they talk about their pelvis being "out of whack" y MUST assess it for education purposes!
- **Measure their leg length!**
- **Educate on X-ray findings!**

Two Birds
- Introduction to asymmetry of human body "Look like a healthy leg length difference!"
- Education on movement protection behaviors

77

FINDINGS CONT

- Terms and concepts such of "out of alignment/place", "rotated", "stuck", "need to be fixed", and even "being tight" (particular related to nerves) have repeatedly demonstrated increasing fear avoidance beliefs, decreased patient confidence, and even decrease their ROM and movement quality!!
- **We are taught that our evaluation and treatment skills are different and less threatening that the dangerous MRI machines.**
- **We're the conservative magical fix with x-ray fingers! All this does is extend the fallacy of needing to be fixed but now with hands vs. blades, resulting in more dependent and less resilient human beings on step away from a spiral of chronicity**

78

CAN MANUAL THERAPY "CORRECT" THE ANKLE JOINT

DYNAMIC PRINCIPLES

Effect of talocrural manipulation in healthy individuals –Fryer et al.
- "Manipulation of the ankle does not increase dorsiflexion range of motion in asymptomatic subjects. Ankles that displayed a greater pretest range of dorsiflexion were more likely to cavitate, raising the possibility that ligament laxity may be associated with the tendency for ankles to cavitate."

Systematic Review of Mobilization and Manipulation of acute and chronic ankle sprains – Loudon et al
- For acute - "It is likely that manual mobilisation has an initial pain altering effect after ankle sprains, but not a mechanical effect"
- Only one study in chronic had a follow-up for 1 month, most were short term, some improvements in dorsiflexon but no study provided evidence for joint position change or mechanical property change

Proximal and distal tibfib manipulation on CAI– Beazell et al.
- No differences in ankle DF, BESS, foot ankle ability sports subscale, or step down comparing 4 sessions of manipulation over 7 days to simply sitting for 2 minutes

79

AN IMPORTANT MANIPULATION STUDY

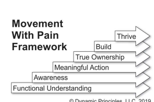
DYNAMIC PRINCIPLES

Manipulation does not alter the position of the sacroiliac joint. A roentgen stereophotogrammetric analysis. – Tullberg et al.
- Imaging before and after in standing and in laying
  - RSA is gold standard 3 dimensional analysis!
- Three osteopathically trained physicians
- 12 SIJ tests were used before and after manipulation
- Tests were positive as deemed by the manual therapist
- Manipulation performed on 10 LBP patients (mostly female!)
- If the manipulation was deemed successful by the manual therapist a repeat image was performed
- Comparison of before and after IMAGING showed no change in SIJ position
- Despite imaging showing NO change, all SIJ tests performed by the manual therapists were reported as "normalized" after manipulation
  - Our perception are skewed by our beliefs!

80

KNEE PAIN – NEW ME

- A person is experiencing pain
- Rule out red flags
- Possibly sensory information is occurring through which peripheral pathways
- Movement with Pain Framework



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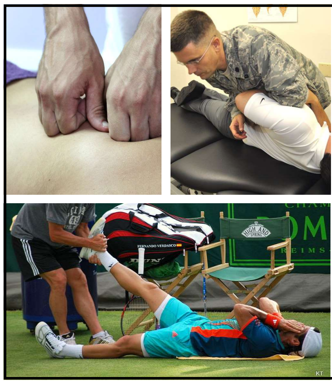

WE CAN AND SHOULD STILL DO THESE!

Just do them for a different reason

- "Your body seems to be holding you a little tense as a why to protect you, let's see if we can help it re-think the situation!"

82

MANUAL THERAPY IS MASSIVE FOR EDUCATION!

Recent research shows that patients (even those who had mechanical tissue based education previous) not only respond well to "Brain based" explanations of manual therapy, their ROM and neurodynamics improve greater than the traditional education methods – And we're actually telling the patients the truth of what we see - Louw

83

MANUAL THERAPY LANGUAGE TWEAKS

DYNAMIC PRINCIPLES

TEACH WITH YOUR TECHNIQUES!!!!

- You carry some tension here lets see if we can help your body rethink this situation with some techniques
- That's a tender spot isn't it? Your body must really think it's an important area to pay so much attention to it! Maybe we can get it to think differently!
- Your body is holding you in this contorted protected position, it's hard for me to tell you how to let it go or even for you to do it, let me try some things with my hand to help you to get your body to trust you
- Lots of protection going on here! Man it's doing a good job, let's see if we can give it a break!
- Its seems like your body is moving around that area for some reason, let's poke and wiggle some things and get it trust that area again!
- How well do you know this area of the body, can you feel this? Do you know what direction I am pressing/stretching/poking? Which of these did you have a harder time feeling?

84

NOT A BIG DEAL YOU SAY?

- "When [the current episode] first happened and after I saw the chiropractor, the only thing that was going through my mind is the seriousness of my dis-alignment [sic] of my back.... I was really petrified...you get scared in the sense that you could damage your spinal cord, or anything, to such an extent that you might become paralyzed"
- Clinically I have had patients state they specifically sought opioids because their PTs and Chiros made them think they were so messed up that clearly they need pain medication to make it through their day!

85

Physical Interaction with the Nervous System

Pain Science, Movement, and Manual Therapy – Overview Course

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NEURO 101

Don't panic!

Your talking to a former neuro moron! If I got this, you got this!

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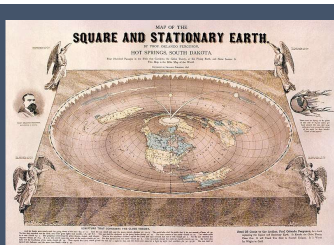
NEUROPLASTICITY

DYNAMIC PRINCIPLES



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- The world is no longer flat
- Our brains change, neural signatures made up of nerve impulses change and structural changes can occur over time, even as a result of thinking
- Not everything we interact with or experience causes major changes, change is still complex
- However, major events with multiple factors concurrently can make immediate lasting changes. IE: PTSD

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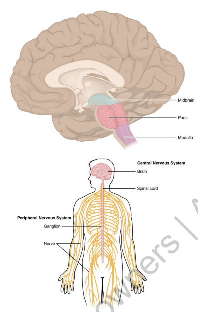
THE NERVOUS SYSTEM

- **CNS** – Brain and spinal cord – PNS interacts
- **ANS** – Located in the medulla oblongata of the lower brainstem
  - PSNS (Rest/Repose)
  - SNS (Fight/flight)

DYNAMIC PRINCIPLES



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SYMPATHETIC SYSTEM GAME CHANGING NEWS!
NOVEMBER 17, 2016

- Sacral Autonomic Outflow is SYMPATHETIC – No longer parasympathetic
- Implications for pelvic floor
- Fight, flight, pee, poop, and sex are all sympathetic functions now (F, F, F, F, P)
- Implications for beliefs about on and off systems, meaning more systems are regulated and modulated by context, not light switches!
- Homeostasis is a DYNAMIC equilibrium across a constantly varying point
- The very nature of static balance is counter to living biology
- Our ability to survive is the ability to be dynamic
- ***CONTEXT!!!***

DYNAMIC PRINCIPLES

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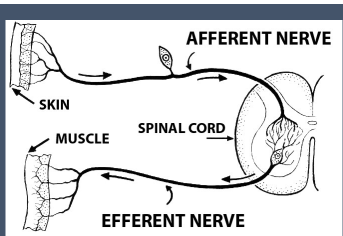
AFFERENT/EFFERENT REVIEW



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- Afferent Tracts – Sensory
  - Information to the brain
- Efferent Tracts – Motor
  - Information to the body
- Neuroimmune process via both pathways

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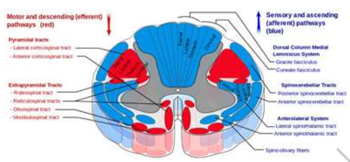
SPINAL TRACTS SIMPLIFIED

Posterior Columns
- 2nd order straight to brain -***Fastest!***
- Touch, vibration, proprioception from skin, pressure
- First order tracts reach to medulla (brain) unlike spinothalamic/cerebellar which synapse on several cell types in the dorsal horn

Spinothalamic tract
- 2nd order SC synapse first, then brain
- Nocioception (NOT PAIN!), crude touch, and temperature

Spinocerebellar tract
- 2nd order SC synapse first, then brain
- Propriception from Golgi tendon organs, muscle spindles, and joint capsules to cerebellum



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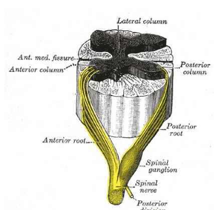
DORSAL ROOT GANGLION

- "Regional mail sorting center" with standing orders from the brain to increase or decrease delivery of information
- Contain the cell bodies of the peripheral nerves providing sensory information to CNS – Some define as part of CNS outside of cord!
- Secondary neuron connections for nocioceptors
- Following nerve injury or inflammation, may increase peripheral nerve excitability and allow for increased transmission of nocioception.
- Can include ectopic (spontanious) discharges after the stimulus has been removed in particular early on in injury.
- Important: Triggers substance P release to neuron terminals or varicosities – Part of neurogenic inflammation process including release of histamine (see fascia section)



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DYNAMIC PRINCIPLES

TOP DOWN/BOTTOM UP

Modulation / Facilitation

- **Ascending** – Often thought of as the entire Gate Control model, but only one piece
  - Classical example: Some form of e-stim stimulates small myelinated neurons which in turn suppress transmission of nocioception from C- and A-delta fibers through "closing the gate"
  - Bottom Up – Decrease OR increase nocioception to the brain
- **Descending** –Midbrain descending system applies both opiod and non-opiod mechanisms to the brain and spinal cord to modulate the experience of pain
  - Activation of inhibitory interneurons throughout spinal cord (DRG standing orders) decreases not only nocioception but also efferent effects such as neurogenic inflammation
  - Top Down – Thoughts, beliefs, emotions
  - DNIC also works via this pathway – Severe noxious stimuli produces inhibition of nocioception local and other areas of the body
  - Can also FACILITATE!

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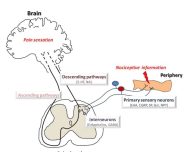

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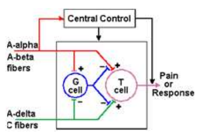

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TOP DOWN/BOTTOM UP

DYNAMIC PRINCIPLES

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DYNAMIC PRINCIPLES

SENSORY INPUT AND MANUAL THERAPY

Mechanoreceptors – Variable tracts

- Skin mechanoreceptor
  - ***Posterior column - fastest to brain***
- Golgi Tendon Organ & muscle spindles
  - Spinocerebellar tracts - Slower
  - ***Proprioception via ligaments, capsules, and muscles are slower than proprioception via skin!***

Nocioceptors – Spinothalamic tract - Slower

- Mechanical, Thermal, Chemical, multimodal

Thermoreceptors – Spinothalamic - Slower

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INTERACTING WITH THE NERVOUS SYSTEM

DYNAMIC PRINCIPLES

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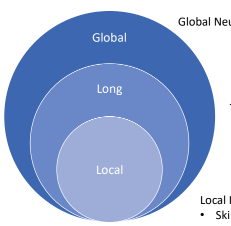

Global Neurophysiology – Whole Person

The Long Wires - Neurodynamics

Local Innervation
- Skin
- Muscle
- Joint/Ligaments
- Bone

DYNAMIC PRINCIPLES

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NEURODYNAMICS

DYNAMIC PRINCIPLES

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FULL COURSES

- ISPI – A Study of Neurodynamics – The Body's Living Alarm
- Michael Shacklock – Clinical Neurodynamics
- NOI - Mobilisation of the Neuroimmune System

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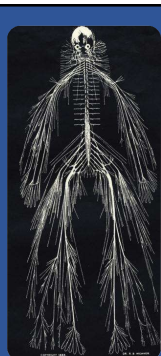
Say hello to Harriet Cole – Drexel University's Longest Serving Employee



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DYNAMIC PRINCIPLES

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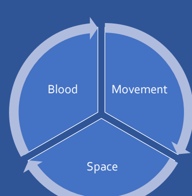
BASICS

DYNAMIC PRINCIPLES

- Nerves are designed to be squished – they only get sensitive to pressure when sensitized!
- Stop with the pinching verbage!
- Focus on nerve health!
- Any movement could be Neurodynamic but we're emphasizing the anatomy and physiology through full excursion here



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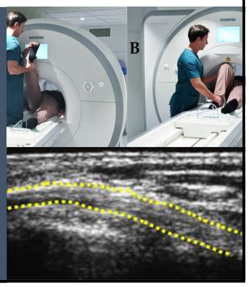
NEURODYNAMICS

Has bad rap
- Adverse neural tension, etc. have resulted in documented damage to nerves when used in previous model!
- Nerves are NOT meant to be under significant and/or extended time stretch – mechanical and anoxic damage - 6-8% lengthening blood flow is slowed – 15% completed occluded
- Scar tissue unlikely – very little if at all

- **Neurodynamics** – Revised in 1995 -Less provocative treatment & explanatory model
  - **Nerve Palpation:** >12 studies demonstrate good sensitivity/specificity
    - Compare to trigger point palpation which only trapezius, glute med, and quadratus lumborum have been reproducible regardless of experience!
  - **Nerve Movement reproducible to testing positions by ultrasound:** >7 studies
  - **Slump:** good sensitivity/specificity/structural differential 5 studies
  - **SLR:** Structural differentiation; specificity; sensitivity; symptomology >16 studies
  - **Upper limb:** Examining the containers; prediction rule for treatments; normative findings; diagnostically; order of movement; sensitivity - >16 studies



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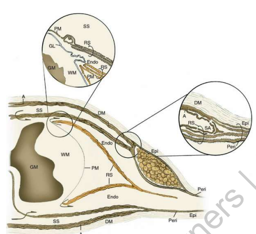
INTRODUCTION TO NEURODYNAMICS

3 Part System
- Mechanical Interface
  - Anything around the nerve – muscle, tendon, fascia, bone etc.
- Neural Structures
  - Brain, cranial nerves and spinal cord, nerve rootlets, nerve roots, peripheral nerves
- Innervated Tissues
  - Any innervated tissue of the body (yes, shock, even fascia!)



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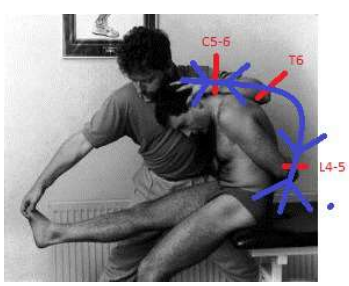
CONVERGENCE

Important property – Nerves function based on "Einsteinian" physics, not "Newtonian"
- Nerves move toward the joint not away
- Mechanical reason why tests are weird sometimes and don't rule out long nerve sensitivity



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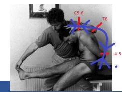
CONVERGENCE



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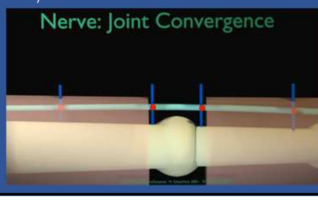

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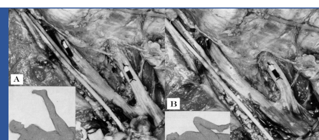
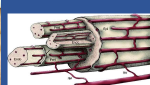
BLOOD/MOVEMENT/SPACE

DYNAMIC PRINCIPLES

- *25% of blood flow dedicated to nerve yet only 2% of body weight*
- *Nerves are blood thirsty vampires – We have to feed them to keep them happy!*



Dye measurement of fluid distribution



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Language changes results!
- "Stretch" – more sensitive less ROM
- "Movement" – less sensitive more ROM

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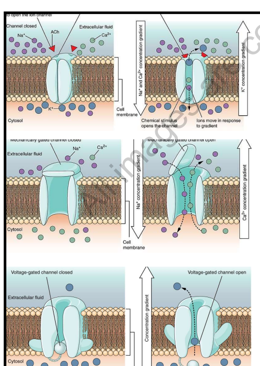

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ION CHANNELS (SENSORS)

- All nerves are myelinated!
- No such thing us unmyelinated!
- Just thinly myelinated!
- Demyelination means more real-estate for ion channels (sensors) – More "sensitive" better able to give info – perhaps too much of a specific type of info!
- Nerves get sensitive!

DYNAMIC PRINCIPLES

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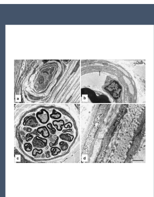
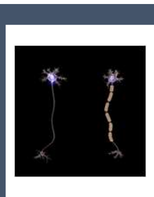
REMOVING MYELIN





- Mechanical
- Chemical
- Immune

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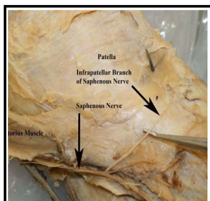

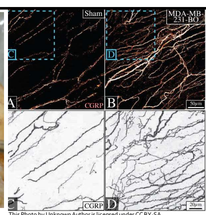

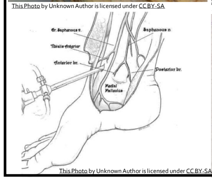

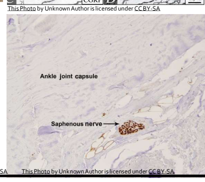

KNEE ARTHROSCOPIES

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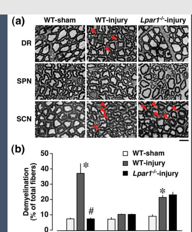
CHEMICAL IRRITATION OF DRG AND NERVE ROOT DEMYELINATION



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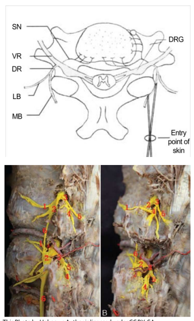

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NERVE ABLATION

DYNAMIC PRINCIPLES

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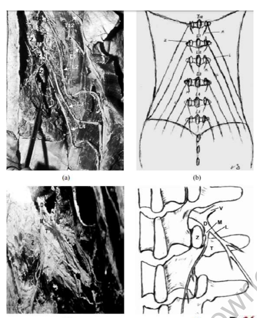
IS IT THE FACET?

Lumbar Dorsal Rami

- "their symptoms usually are on one side and are exacerbated by lumbar extension and/or rotation. This pain may radiate to the ipsilateral low back and buttock region. Some patients may present paraspinal muscle spasm. Hyperesthesia may present in the affected dermatome" – Fukui



DYNAMIC PRINCIPLES

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CHRONIC ANKLE SPRAIN

Demyelination of peroneal n. a common finding in CAI!

DYNAMIC PRINCIPLES

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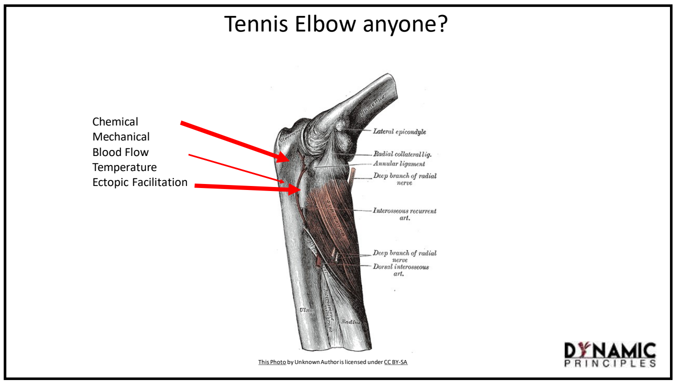
Tennis Elbow anyone?
Chemical
Mechanical
Blood Flow
Temperature
Ectopic Facilitation
Lateral epicondyle
Radial collateral lig.
Annular ligament
Deep branch of radial nerve
Interosseous recurrent art.
Deep branch of radial nerve
Dorsal interosseous art.
DYNAMIC PRINCIPLES
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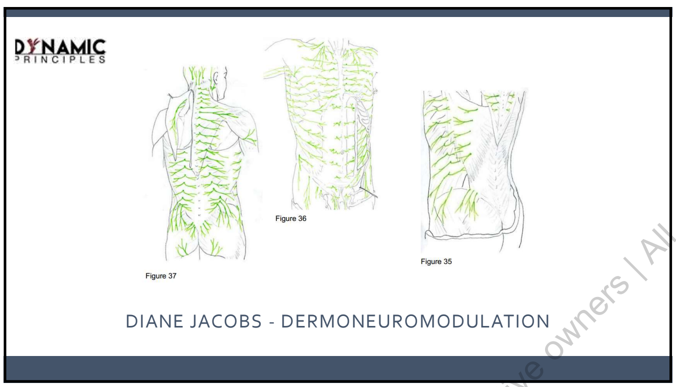
DYNAMIC PRINCIPLES
Figure 37
Figure 36
Figure 35
DIANE JACOBS - DERMONEUROMODULATION

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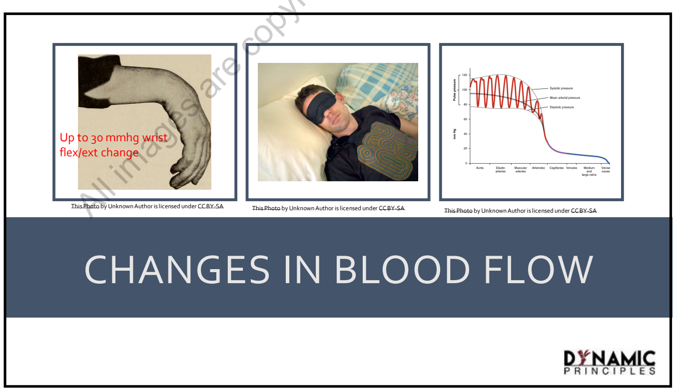
Up to 30 mmhg wrist flex/ext change
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CHANGES IN BLOOD FLOW
DYNAMIC PRINCIPLES

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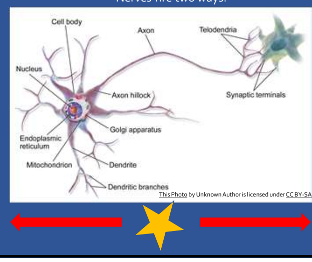
NEUROGENIC INFLAMMATION

Nerves fire two ways!



DYNAMIC PRINCIPLES

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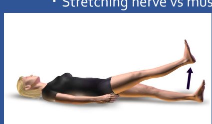
WHY EDUCATION FOR NEURODYNAMICS?

- A randomized controlled trial of intensive neurophysiology education in chronic low back pain. – Moseley, Nicholas, Hodges
  - SLR Improved 5 degrees
  - Forward trunk flexion - 4cm
- Stretching nerve vs muscle descriptors changes SLR!



DYNAMIC PRINCIPLES

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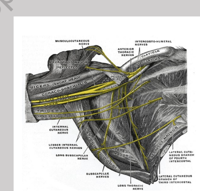
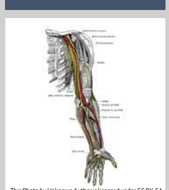
DYNAMIC PRINCIPLES

MEDIAN

Terminal Position:
- Whole arm in ER
- All joints extended
- Shoulder abducted





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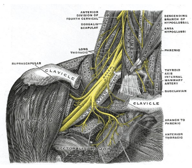

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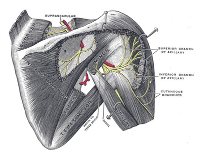

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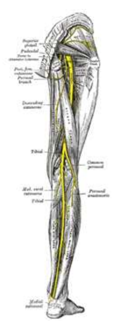
AC JOINT/SHOULDER PAIN

Suprascapular n. provides sensory to both AC and GH!
Calm the nerve, let the joint take care of itself!

DYNAMIC PRINCIPLES

121



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SCIATIC/TIBIAL/PERONEAL

- There are no true standards of ROM, dancers might need 150+ before tensioning the sciatic!

Do tight hamstrings exist?

  - Never been associated with any pain or relief BTW
  - You can improve ROM with Stretch tolerance but for what purpose?

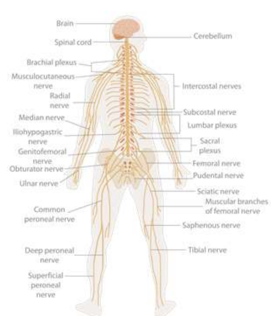
DYNAMIC PRINCIPLES

122

TYPES OF TEST

- Active Neurodynamic Tests – Quick Screen
- Passive Neurodynamic Test
  - Proximal To Distal
  - Distal To Proximal
  - Middle out
  - Slump Testing
    - Top to bottom
    - Bottom to top

DYNAMIC PRINCIPLES



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123

TEST BECOMES THE TREATMENT AND BEYOND

- Follow the neuro anatomy for functional neurodynamics
- Allow the median n to be fixated distally and take load
- Sliders/Glides
- Tensioners
  - Possibly only for graded exposure – always follow with slider
- Manual therapy based on creating space proximal to distal and addressing neural containers!
  - Infinitely cool mobilization and slackening/tensioning options including combined with manipulation

DYNAMIC PRINCIPLES

124

DYNAMIC PRINCIPLES

TREAT THE NERVE

- Just because the long nerve isn't coming up with stress testing doesn't mean that doing assistive and home neural glides won't feed the nerve and make it happier whatever the cause of pain
  - *Negative Neurodynamic Tests Do Not Exclude Neural Dysfunction in Patients With Entrapment Neuropathies – Baselgia, et al.*
- The kitchen sink works here, has been studied several times with wide spread pain, glide and slide all the ends of the nerve to mess with the nerve health and somatosensory cortex
- Remember the acute and subacute injuries like ankles!

125

DYNAMIC PRINCIPLES

WHAT ARE WE DOING?

- Movement of fluid in/around tissue and especially tunnels
- Change in pressure gradients; think tunnels
- Decrease mechanosensitivity of the nervous system
- Blood flow increases
- Axonal fluid movement helped
- Disperse inflammatory chemicals around neural tissue
- Activation of descending inhibitory systems
- Increased somatosensory cortex clarity
- Creating space for neural tissue
- Possible small subacute scarring minimizing – EXERCISE CAUTION!
- Safe, skillful handling in a therapeutic environment

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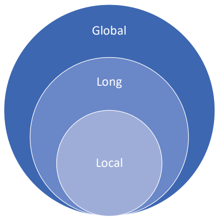

DYNAMIC PRINCIPLES

127

THE COOLEST FORGOTTEN THING IN MANUAL THERAPY: SKIN!

- Joints, muscles, and fascia get all the attention
- Before you touch anything, you touch the skin,
- Regardless of what manual therapy technique you do, *you are always touching the skin throughout the technique*

SKIN IS THE OUTSIDE OF THE BRAIN!!

DYNAMIC PRINCIPLES

128

THERAPEUTIC TOUCH

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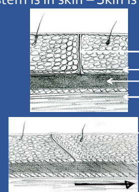
Skin and cascade of events (Winstead & Kijek)
- Decreased pain
- Decreased anxiety
- Improve ROM/Strength
- Improved functional capacity
- Improved skin healing

DYNAMIC PRINCIPLES

129

DERMONEUROMODULATION

- Great thanks to Diane Jacobs
- Derived from neurodynamics
- Furthest terminal of peripheral nervous system is in skin – Skin is the outside of the brain – Wake up that homunculus!
- Where do all physical interventions begin?
- The skin
  - A-Beta from skin fastest
  - Descending modulation
  - Anoxia?
  - Proprioceptive/kinesthesia



Images courtesy of Diane Jacobs

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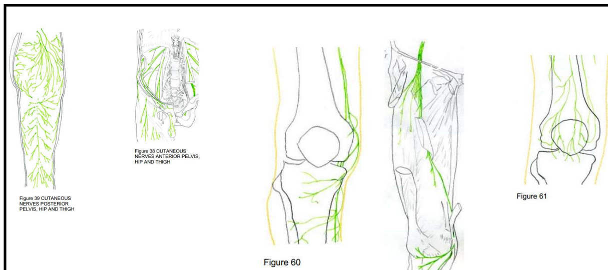

Figure 39 CUTANEOUS NERVES POSTERIOR PELVIS, HIP AND THIGH

Figure 38 CUTANEOUS NERVES ANTERIOR PELVIS, HIP AND THIGH

Figure 60

Figure 59

Figure 61

Images courtesy of Diane Jacobs

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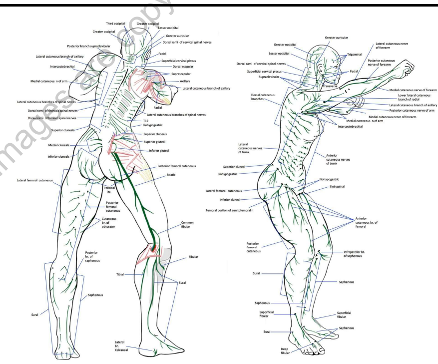

Images courtesy of Diane Jacobs

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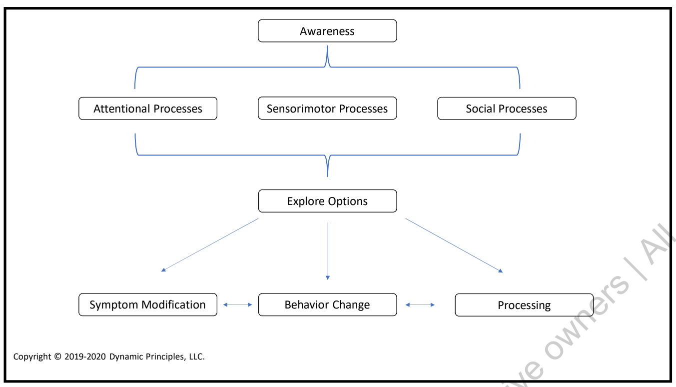
SKIN PROPRIOCEPTION

- Skin proprioception trumps joint and GTOs, in the brain long before the joints and muscle know where they are (dorsal columns vs. spinothalamic) -Spilman
- Evidence that skin proprioception more important than joint proprioception -Lowrey et al.
- Kinesthesia tricks
  - Voodoo/Mobility bands
  - KT tape
  - Makes area feeling like it is "already" in position without threat

DYNAMIC PRINCIPLES

133



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MANUAL THERAPY INTEGRATION

1

FUNDAMENTAL

Do no harm

2

"SUGGESTED" ORDER OF OPERATIONS

1) Rule out red flags
2) Person First – story, context, experience, therapeutic alliance, therapeutic staging
3) Nerve needs - Neurodynamics and interactions – Blood/movement/space
   - What are the peripheral nerves that would provide sensory input?
4) Threat analysis and decreasing threat
5) Increase confidence and variability through your manual therapy skills
6) Observe for all factors involved in load capacity to determine how to improve

3

RISK LEVELS

- Primary – Tissue Damage
- Secondary – Continued or worsening sensitization
  - Don't assume someone is "tough", nervous system can heighten both as a result of beliefs and also in regards to excessive threat

4

MOVEMENT AND MANUAL THERAPY

- Finding ease and movement with attention independently, then use manual input and active dialog to help patient realize they could be more at ease, they can experience their body more clearly in a non-threatening way
- Make manual therapy a tool for ***self awareness*** – it should make their ability to apply awareness and recover their movement easier – not just ROM
- Build loading capacity – more and more indep!

5

TREATMENT EXPERIENCE

Patient/Client relaxed and present - avoid distraction

Patient experience trumps what you feel

Support free floating limbs

Delivery of technique based on patient experience

"Relax into the technique" work on your own breathing and presence to reduce contributor stress

This is an environment of "rest and repose"

AT room might not always be best environment for certain patients!

6

"ONE AND DONE" TREATMENTS VS MULTIPLE SESSIONS

One and done treatments exist across every manual therapy intervention

- None of them more common than the other, enjoy it when it happens, but DON'T give a "healer/fixer" story – reinforce this is a multi-system processing change.
- Likely these again are related to the "Self as a Process" in which awareness of self can create profound changes in function.

7

DNIC HEAVY APPROACHES

- You can adhere to DNIC techniques but at the very least, read your patient before you do
- Be aware of peripheral and central sensitization can occur in the toughest individuals (a lot of military and former tactical athletes!)
- Best use of DNIC would be to ensure the patient is fully present (IE: not distracted, texting, talking, etc) and even visualizing decreasing of tone as well as deep breathing, in particular if self treating through foam rolling

8

LISTEN

LOOK

FEEL

DISCUSS

TRY

9

DECIDING HOW TO INTEGRATE MT

LISTEN to the person FIRST
- Have they had bad experiences with manual therapy before
- Do they have preference on the type of manual therapy?
- Recognize why manual therapy could be a bad idea at that moment
  - Expectations for a "fix"
    - "If you fix them, you will wreck them"
  - Clues of possible sensitization
  - Trauma

LOOK at the behavior of the body
- Global/Regional/Local
- Ask yourself one question – Does the body (global/regional/local) look like it is trying to protect itself?

FEEL the area
- Ask for permission!
- Does this feel like it is trying to protect itself?
- Use PROM unconscious resistance to movement for assessment and education
  - Can be useful for technique selection

DISCUSS your findings
- Functional understanding to the max!
- Introduce the idea of an experiment to introduce variability and see if you can help them experience a change which may help with the quality of their movements and their independent practice
- Ask permission

TRY things out
- Client/patient preference and presentation
- Be observant and caring with your techniques
- Better off going with lower intensity before ramping it up

10

MT MORE SPECIFIC THOUGHTS

- **Paresthesias need to be normalized quickly –"Just a change in blood flow or a change in awareness of blood flow"**
- Bring the client/patient actively into the treatment – Where am I pressing, which direction am I going, which way is easier, which is harder, etc.
- Consider "capsular" feel assessment as an assessment of guarding and a measure of sensitivity
  - Learn to give these feels space, often it will change as the system calms without any direct intervention, even your listening and/or education may improve it
- Remember the fundamentals of neurodynamics and connect the behavior of the tissues to neurodynamic understanding – IE: Scalenes
- R1 & and R2 are helpful designations for onset of sensitivity in documentation
- Consider many of your techniques as being "live" dynamic assessments and concurrent dynamic treatment – Adapt to the behavior of their body through the technique rather that only passively imposing your will on their tissues
  - HVLA different context – In this case, if appropriate, present it as an experiment on speed variation to see if the system will change its guarding behaviors – this also covers you for if you get a negative result!

11

Global Meaningful Action

Pain Science, Movement, and Manual Therapy – Overview Course

DYNAMIC PRINCIPLES

12

SLEEP

- Foundation to everything!
- No single factor more influence of pain, injury risk, and health
- Youth athletes particularly at risk - Milewski, et al.

BUT BE CAUTIOUS NOT TO CREATE A NEW FORM OF NOCEBO!

DYNAMIC PRINCIPLES

13

SLEEP

CBTi for insomnia is considered the "Gold Standard"
   Behavioral change strategies most potent sleep improvement over time

Newcomer – ACT for Sleep – *My success story*

Do not give unrealistic expectations – looking at improving existing quality of sleep first, if only 2 hours at a time, want those to be best quality of those two hours. Sky is the limit beyond that but will take practice

Mainstay medications in pain medicine for pain is trazodone, use of membrane stabilizing agent, and possible muscle relaxant sometimes used for sleep
   Concerns of abuse with benzos such as Ambien and the cycle of withdrawal post short term use

Figure out their postures, most don't have pillows under or between their knees, it could be as simple as that

May identify individuals who need testing for sleep apnea, prop em up and see how they do!

Power Naps!

DYNAMIC PRINCIPLES

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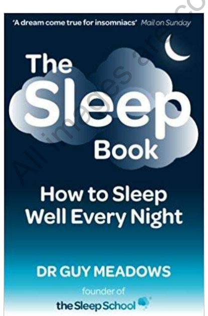


SLEEP – ACT APPROACH

15

PACING

- No universal definition - Fundamentally pacing is efficiently balancing work to recovery for sustaining activity. It is paying respect to your physiology, knowing how far/how intense/how long you can go before you must rest to allow you to do more
  - It is not just physical, cognitive, and even emotional pacing are unique variables
- It is vitally important not to consider it a "one off", you cannot in one session help a person pace all aspects of their life. You need to work on those throughout the plan of care with your patient. An occupational therapist can be immensely valuable here
- It is also important pacing is integrated with Functional Understanding:
  - What taking a break from activity means is important:
    - If breaks are believed necessary to protect an area, such as an joint, fear may increase regarding "damage" from overuse and this may worsen function and pain (see for OA of knee from Murphy et al.).
    - If instead the break is reframed as a way to "refill" the physiologic tank to allow the body recovery and do more, as well as more effectively build greater tolerance of time, there is little risk for inducing fear about "damage"

16

BREATHING

Barely touching the surface, but briefly

- Inhale – Sympathetic
- Exhale – Parasympathetic

Role of Autonomics in Breathing

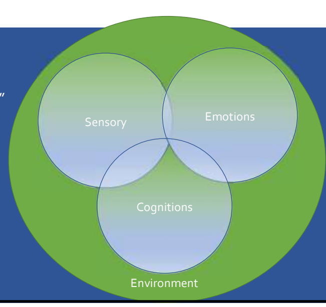
- In normal
  - Cold Noxious more painful when more sympathetic – Victor et al.
- In painful
  - Elevation of sympathetic tone frequently replicated in patients with persistent pain - Martínez-Lavín, et l.
  - Self reports of mood and stress levels do not conform to autonomics in stress reduction tasks – Lush et al.
- Deep Slow Breathing (DSB)
- Biofeedback tools help create a feeling of relaxation but do not as effectively influence autonomics as self guided breathing– Busch et al.
- Sympathetic modulation and decreased pain with deep slow breathing –Hassett et al.

Dosing
  - Minimum 5 minute rounds
  - In research 5x3 with 1 minute between per session – Busch et al.

17

FINDING EASE / MOVEMENT WITH ATTENTION

- Awareness
- Introduce options and variability
- "Give permission to be more comfortable"
- Movement with attention



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AEROBIC EXERCISE

- EVERY Patient by day 2 needs to be started on this –
  - Feed the nerves, remember 25% of blood goes to the nerves – BLOOD/MOVEMENT/SPACE!
- Minimum 10 minutes
  - may take graded exposure to build up to it but try and find easiest to get there
- Heart Rate: min – 100-105 bpm | max: 120ish – otherwise toward anaerobic and many don't tolerate
  - Beta blockers and tachy use 20% increase
- Education is key —integrate its vital role during the eval and first explanation

19

BEHAVIOR CHANGE

20

BIO-PSYCHOSOCIAL AND THE PHYSICAL REHABILITATION SPECIALIST

- Stop assuming that the counselor/psychologist is taking care of this - They may need BOTH of you
- Many psychologists do not understand pain biology and many don't even see their role in pain!
- Some patients who have seen counselors for years aren't seeing the relationship of their thoughts and emotions to pain!
- Many times you will connect a stressful or traumatic event more clearly with their pain experience than anyone else

MOST IMPORTANT – You will be the educated one to tell the patient that this isn't some psychosomatic thing

- ***They are NOT imagining their pain!***
- ***They CANNOT think their pain away!!***
- ***ALL PAIN IS REAL!***

21

NOT MY SCOPE? - MICHIGAN

Public Health Code Part 178 - 333.17801 Definitions; principles of construction.

"Practice of physical therapy" means the evaluation of, education of, consultation with, or treatment of an individual by the employment of effective properties of physical measures and the use of therapeutic exercises and rehabilitative procedures, with or without assistive devices, for the purpose of preventing, correcting, or alleviating a ***physical*** or ***mental disability***.

22

23

SOCRATIC QUESTIONING

Dumbed down version

- Teacher/facilitator expresses ignorance of the topic in order to gain engaged dialog with the participant

Six Types of questions – Samples from UofM Resource

1. Questions for clarification:
   - Why do you say that? How does this relate to our discussion?
2. Questions that probe assumptions:
   - What could we assume instead? How can you verify or disapprove that assumption?
3. Questions that probe reasons and evidence:
   - What would be an example? What do you think causes to happen...? Why:?
4. Questions about Viewpoints and Perspectives:
   - What would be an alternative? What is another way to look at it? What are the strengths and weaknesses of...?How are...and ...similar? Questions that probe implications and consequences:
5. Questions about the question:
   - What generalizations can you make? What are the consequences of that assumption? What are you implying? How does...affect...? How does...tie in with what we learned before?

24

MOTIVATIONAL INTERVIEWING

- MI attempts to increase the client's awareness of the potential problems caused, consequences experienced, and risks faced as a result of the behavior in question. - Brodie et al.
- MI seeks to help clients think differently about their behavior and ultimately to consider what might be gained through change. – Cummings
- Motivational interviewing is non-judgmental, non-confrontational and non-adversarial – Miller et al.

DYNAMIC PRINCIPLES

25

The Four "basically adequate world hypotheses" (World Views)

Reminder!

Essentially 4 ways of looking at the World – Stephen C. Peppers

- **Formism** – Naming, classifying, organizing – IE: Medical diagnosis, personality types, etc.
- **Mechanism** – How do parts come together in a machine
- **Organicism** – Organic system – how do things ultimately fit together – Common with stage theories – development phases
- **Contextualism** – Action, utterance, or expression can only be understood in context
  - History and circumstance – the small details might sometimes be important but sometimes larger things are important - You can think from tiny details to large scope and then back to tiny again

26

DIFFERENT WAVES OF BEHAVIORAL CHANGE

- **Wave 1: Behaviorism** – EG: Operant conditioning, classical conditioning
- **Wave 2: Cognitive Behavior Therapy** – Change behavior related to thoughts, beliefs, and understanding
  - A focus on "dysfunction"
- **Wave 3:** Behavioral and cognitive therapy sensitive to the context and functions with an emphasis on contextual and experiential change strategies
  - Functional Contextualism
    - ***Relational Frame Theory – More in later courses!***
  - A focus on "workability" with context

27

COMPARE AND CONTRAST OF PSYCHOLOGY AND REHABILITATION MECHANISTIC MODELS

Comparisons based on writings in Russ Harrison's ACT Made Simple
**Not word for word - some variation of his writing was made to better fit this comparison

Psychology mechanistic models for mental health

Many clients approach psychological therapy with mechanistic idea. They believe they are faulty, damaged, or flawed and therefore need to be "fixed" - how many times have you heard a patient/client use the term "I am damaged goods"?

They believe they have "faulty parts" – negative thoughts, anxiety, or painful memories than need to removed

Many psychology MECHANISTIC models readily reinforce the notions through two processes:

1. Often terms such as "dysfunctional", "maladaptive", "irrational", etc. which imply we have faulty or damaged components to our minds
2. A variety of tools/techniques used to directly reduce, replace, or remove unwanted thoughts and feelings are provided with the assumption this is essential to stepping forward in improving quality of life

Rehabilitation (PT/AT/OT/MD/DO/Chiro) mechanical models for 'physical' health

Many clients approach Rehabilitation with mechanistic idea. They believe they are faulty, damaged, or flawed and therefore need to be "fixed" - how many times have you heard a patient/client use the term "I am damaged goods"?

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DYNAMIC

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NOCEBO IS EVERYWHERE!

DYNAMIC

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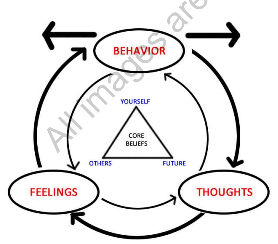

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COGNITIVE BEHAVIOR THERAPY

CBT is a short-term, goal-oriented psychotherapy treatment that takes a hands-on, practical approach to problem-solving. Its goal is to ***change patterns of thinking*** or behavior that are behind people's difficulties, and so change the way they feel. – Martin

Six Phases

1. Assessment or psychological assessment
2. Reconceptualization
3. Skills acquisition
4. Skills consolidation and application training
5. Post-treatment assessment follow-up
6. Generalization and maintenance

ACT considers many CBT Techniques as "control" techniques

30

BE 'MINDFUL' ABOUT MINDFULNESS

- "Pure"" mindfulness approaches can be great for many patients but might need to be "mindful" of it
- No Panacea - Recommend a seasoned teacher – not without risks!
  - Rare but documented evidence for worsening mental health for certain individuals – worsening depression and anxiety
  - Zen Monks have been documented going psychotic – "Dark Night Phenomena"
    - "irreversible insight into emptiness" and "enlightenment's evil twin" – Doesn't sound pleasant..
  - Mostly associated with prolonged meditation and silent retreats
  - If it doesn't appear the patient has good coping strategies to delve into their emotions is a good indication for a referral!
- Can we combine mindfulness with something else for grounding?

31

MINDFULNESS + VALUES + COMMITTED ACTION

32

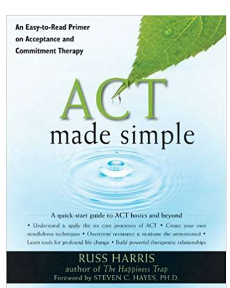
ACT – ACCEPTANCE AND COMMITMENT THERAPY

Aim of ACT "is to create a rich, full, and meaningful life while accepting the pain that inevitably goes with it" – Harris

ACT emphasizes that humans get STUCK, they are not broken

ACT does not set out to reduce or eliminate "symptoms" instead the aim is to transform the clients relationship with their feelings and thoughts so that they long perceived them as symptoms. If we label a thought or a feeling as a symptom it implies that it's bad, harmful, abnormal, therefore something we need to get rid of in order to be normal and healthy

Think about reframing pain



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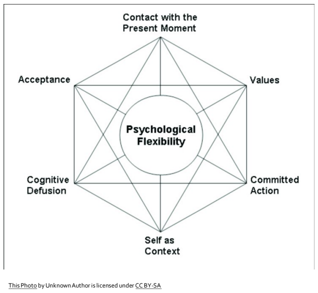

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DYNAMIC PRINCIPLES

ACT - HEXAFLEX

Contacting the Present Moment
Be here now

Defusion
Watch your thinking

Acceptance
Open up

Self-as-Context
Learning about Observing Self

Values
Know what matters

Committed Action
Do what it takes

Second acronym for ACT
- A = Accept your thoughts and feelings, and be present
- C= Choose a value direction
- T= Take action

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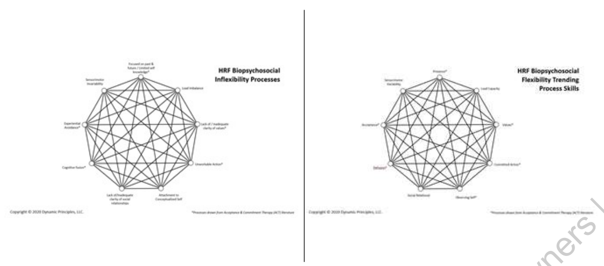

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COHERENCE IN BEHAVIOR CHANGE

- We must develop coherence for sustainable behavior change.
  - Coherence is a general reinforcer of behavior change.
  - If we're shifting perspectives of our recommendations arbitrarily, we risk loosing coherence.
- Pairing psychological flexibility with a rigid mechanistic perspective of physical therapy could result in a loss of coherence.
- If we prescribe exercises to be done ongoing and they are not coherent with the functional understanding and experience of the client, sure those exercises might provide some short-term benefit (aka control strategies) but at some point, they lose their value.
  - Case in point: I was diligent on core exercises, hip "Activation", and mobility exercises for 10 years – These never yielded me more than short-term benefit, once I learned the scientific evidence did not support them, that I didn't need them, and I had started to live by MWPF processes, there no longer a need for me to ever go back to them, to do so would be incoherent with my functional understanding and experience with pain.

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ROLE OF AWARENESS IN BEHAVIOR CHANGE

- We use awareness tools to open doors toward behavior change.
- We draw on process-based approaches from ACT to encourage psychological flexibility for change.
- Movement with Attention (MWA) and Finding Ease (FE) Practice is our most common step toward this process
  - IE: Sitting, standing, walking etc.
- MWA & FE does not always facilitate this opening - Therefore, we also draw on processes such as those common in ACT but also with ongoing development of strategies rooted in RFT and Functional Contextualism.
- When clients struggle with flexibility, often we find we are not being flexible either, YOU are equal part of the therapeutic alliance
  - Just don't let the client derail you from helping them get unstuck, sometimes a well-timed "Creative Hopelessness" practice is necessary or perhaps creating contextual space "Let's step over here and observe the two of us, what are we noticing here?"

37

YELLOW FLAGS

- Yellow Flags guide your education and your plan of care
- Make a list of them during the evaluation – start with their beliefs about their problems!

DYNAMIC PRINCIPLES

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Workplace (Think sport for athletes)
- Belief that all pain must be abolished before attempting to return to work or normal activity
- Expectation/fear of increased pain with activity/work
- Poor work history
- Unsupportive work environment

Attitudes and Beliefs
- Belief that pain is harmful, resulting in avoidance and poor compliance with exercise
- Expectation of "techno-fix" for pain

Social/Family
- Overprotective partner/spouse
- Social punitive partner/spouse
- Lack of support to talk about problems

Behaviors
- Passive approach to rehabilitation
- Use of Extended Rest
- Reduced activity with withdrawal from activities of daily living
- Avoidance of normal activity
- Impaired sleep because of pain
- Increase intake of alcohol or similar substances since the onset of pain

Affective/emotions
- Depression
- Feeling useless
- Irritability
- Anxiety about heightened body sensations
- Disinterest in social activity

DYNAMIC PRINCIPLES

New Zealand Acute Low Back Pain Guide: Incorporating the guide to assessing psychological yellow flags in acute low back pain, Wellington, 2004.

39

FEAR AVOIDANCE VS PERSISTENCE BEHAVIOR

DYNAMIC PRINCIPLES

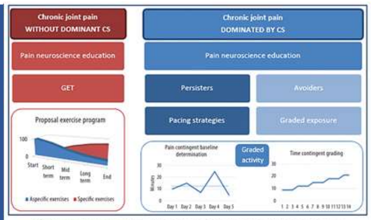

Fig. 2. Overview of the possible design of exercise or activity programs. CS, central sensitization; GET, graded exercise therapy.

Moving on to Movement in Patients with Chronic Joint Pain – IASP Pain Clinical Updates March 2016

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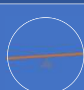
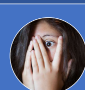
GRADIENTS OF BEHAVIOR

DYNAMIC PRINCIPLES

Persistence Behavior



Somewhere in middle – or it depends context



Avoidance Behavior

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REMINDER

Some people are just not ready and may have to struggle longer until they are ready to move forward. This is psychological inflexibility, not intelligence or lack of knowledge. We do our best to help them shift to flexibility but sometimes they simply need to "fail more" before they are ready.

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Graded Motor Imagery

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DYNAMIC PRINCIPLES

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FURTHER RESOURCES

NOI Graded Motor Imagery

ISPI – Too Hot to Handle

DYNAMIC PRINCIPLES

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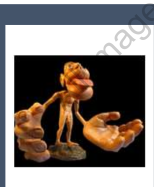
HOMUNCULUS

DYNAMIC PRINCIPLES



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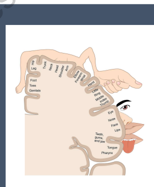

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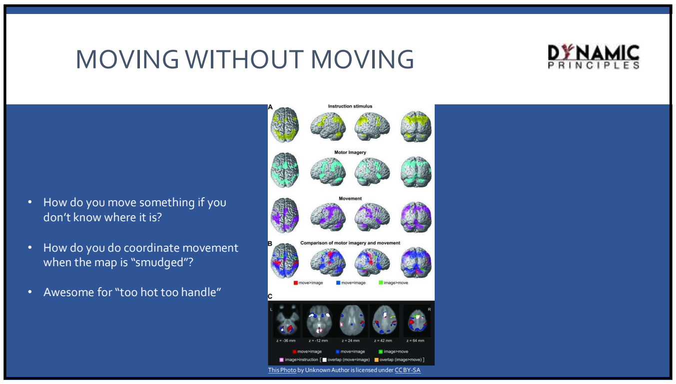
- Notice how poorly the back is represented on the homunculus!
- No wonder LBP is number 1 followed by neck!
- Pelvis is neighbor to what?
- Face is neighbor to what?

45


MOVING WITHOUT MOVING
DYNAMIC PRINCIPLES
• How do you move something if you don't know where it is?
• How do you do coordinate movement when the map is "smudged"?
• Awesome for "too hot too handle"
Instruction stimulus
Motor Imagery
Movement
Comparison of motor imagery and movement
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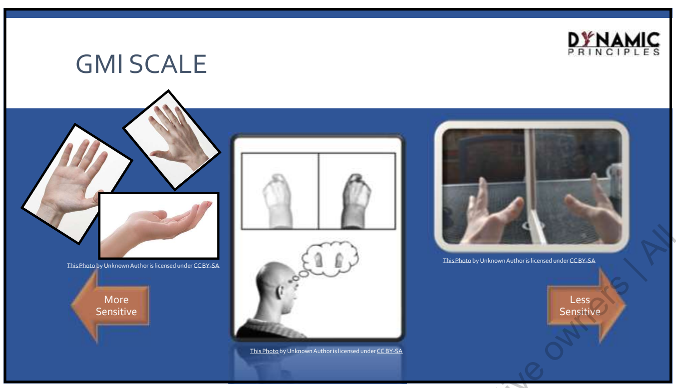
GMI SCALE
DYNAMIC PRINCIPLES
This Photo by Unknown Author is licensed under CC BY-SA
More Sensitive
This Photo by Unknown Author is licensed under CC BY-SA
This Photo by Unknown Author is licensed under CC BY-SA
Less Sensitive

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LATERALITY
DYNAMIC PRINCIPLES
• Foundation of GMI
• If you don't know where it is, how do you use it?
• Objective measure
• Must recognize variable between cards vs. apps
This Photo by Unknown Author is licensed under CC BY-SA

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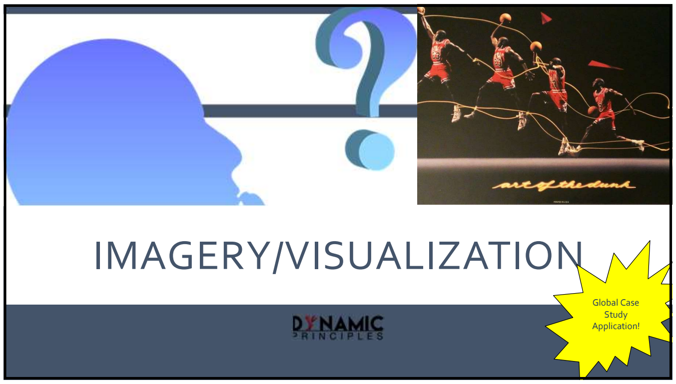
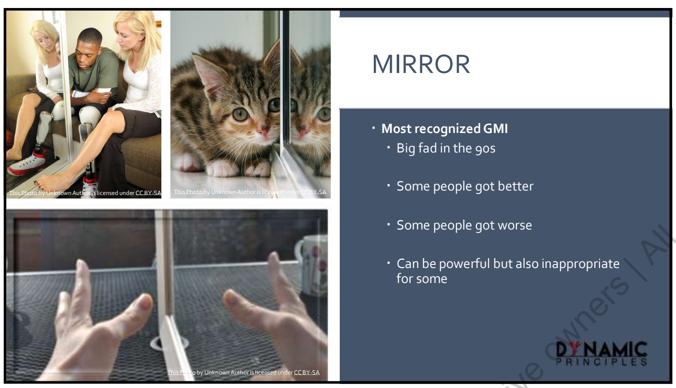
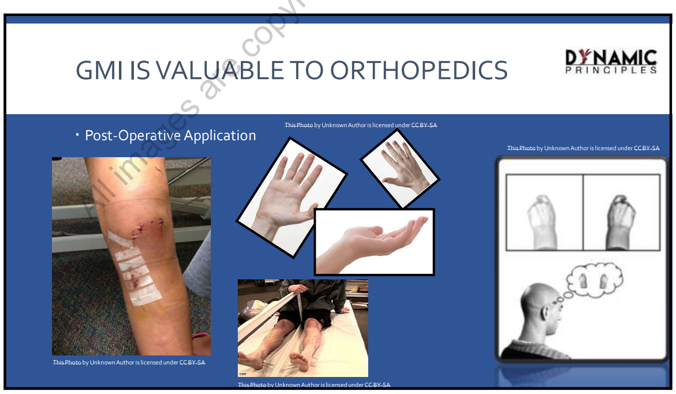

IMAGERY/VISUALIZATION
Global Case Study Application!
DYNAMIC PRINCIPLES

49


MIRROR
Most recognized GMI
Big fad in the 90s
Some people got better
Some people got worse
Can be powerful but also inappropriate for some
DYNAMIC PRINCIPLES

50


GMI IS VALUABLE TO ORTHOPEDICS
DYNAMIC PRINCIPLES
Post-Operative Application
This Photo by Unknown Author is licensed under CC BY-SA

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ACUTE ANKLE SPRAIN

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OTHER ORTHOPEDICS?

- "Frozen" shoulder
- Painful extremity – IE: Symptomatic OA
- LBP
- Neck pain
- HA/Face pain
- Motor control! – If you don't know where it is, how can you use it?

53

VIRTUAL REALITY & PHYSIOLOGIC EFFECTS

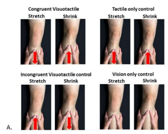
Donati, Ana RC, et al. "Long-Term Training with a Brain-Machine Interface-Based Gait Protocol Induces Partial Neurological Recovery in Paraplegic Patients." Scientific Reports 6 (2016).

54

GMI & TACTILE ON COMBINED

“Visuotactile illusions are analgesic in people with knee OA. Our results suggest that visual input plays a critical role in pain relief, but that analgesia requires multisensory input. That visual and tactile input is needed for analgesia, supports multisensory modulation processes as a possible explanatory mechanism”

A.



B.

	Most analgesic illusion	
Control Condition	***Congruent stretch***	***Congruent shrink***
Tactile stretch		
Tactile shrink		
Visual stretch		
Visual shrink		
Incongruent stretch	Controls for vision; Tactile input differs	Controls for tactile; Visual input differs
Incongruent shrink	Controls for tactile; Visual input differs	Controls for vision; Tactile input differs

Stanton, Tasha R., et al. "Illusory resizing of the painful knee is analgesic in symptomatic knee osteoarthritis." *PeerJ* 6 (2018): e5206.

55

OUTCOMES

Decrease pain and disability for CRPS, acute limb trauma and limb surgery
- Thieme, Holm, et al. "The Efficacy of Movement Representation Techniques for Treatment of Limb Pain—A Systematic Review and Meta-Analysis." The Journal of Pain 17.2 (2016): 167-180.

Decrease pain and disability in LBP
- Daffada, P. J., et al. "The impact of cortical remapping interventions on pain and disability in chronic low back pain: a systematic review." Physiotherapy 101.1 (2015): 25-33.
  Decrease pain and disability post spine surgery
- Louw, Adriaan, et al. "Moving without moving: immediate management following lumbar spine surgery using a graded motor imagery approach: a case report." Physiotherapy theory and practice 31.7 (2015): 509-517.

Decrease HA and face pain
- Piekartz, Harry von, and Gesche Mohr. "Reduction of head and face pain by challenging lateralization and basic emotions: a proposal for future assessment and rehabilitation strategies." Journal of Manual & Manipulative Therapy 22.1 (2014): 24-35.

DYNAMIC PRINCIPLES

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GRADED EXPOSURE

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GRADED EXPOSURE

Graded exposure for movement is based on the psychological model of treating fear avoidance. It is a carefully design process by which you slowly and progressively expose yourself to one or more forms of stress, physical/cognitive/emotional and an effort to make you less sensitive to that form of stress.

Graded exposure is not the same as "graded activity", which is simply increasing physical stresses. Avoidance or fear must be present and the scale of this avoidance/fear must be placed in a hierarchal order. The patient/client is actively involved in the decision making process to create an "Experimental hypothesis" in which a movement is ranked from most or least threatening. Typically, the mild to moderate level movements/behaviors being the entry point to the plan. These movements/behaviors can then be gradually exposed to the client through a variety of strategies

- In vivo exposure: Directly facing/addressing the movement/behavior
- Imaginal exposure: Imagining the movement/behavior
- Virtual reality exposure: Use of technology to be exposed to the movement/behavior
- Interoceptive exposure: Replicating the physical sensations of a feared movement/behavior – EG: flexion of lumbar spine introduced in supine through hip flexion passively asking the client to sense the movement rather than through active movement

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IS FEAR OF MOVEMENT A PROBLEM?

YES

- Pain-Related Fear Contributes to Self-Reported Disability in Patients with Foot and Ankle Pathology – Lentz et al
- Pain-Related Fear Contributes to Self-Reported Disability in Patients with work related upper extremity pain - de Jong et al.
- Pain-Related Fear Contributes to Self-Reported Disability in Patients with osteoarthritis – Heutes et al.
- Pain-Related Fear Contributes to Self-Reported Disability in Patients with low back pain – Macedo et al.

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EFFICACY OF GRADED EXPOSURE

Graded exposure is highly effective for improve function and decreased catastrophizing in
- Chronic Low Back Pain – Leeuw, et al., Macedo et al. Vlaeyen et al.
- CRPS – de Jong et al., van de Meent, et al.
- Upper extremity pain - de Jong et al.
- Neck pain - de Jong et al.

Virtual Reality is effective as well – Parsons, et al.

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"MEANINGFUL" EXPOSURE

- Patient Suggestion

62

GRADED EXPOSURE

- Disability outpaces pain
- "The nervous system can be like a spoiled child, you can't just feed it candy all the time" – Jo Nijs
- Graded exposure is context oriented physical/cognitive/emotional exposure to an activity, typically for fear avoidance beliefs of an activity
  - An interactive process of creating an experiment for the client and gradually increasing the scope of that experiment
- Graded Activity is for addressing deconditioning-These people have LOW LOAD CAPACITY!
  - Aerobic plan begins day 1 or day 2!!
  - MUST be independent – don't waste time in your session unless needed to demonstrate ability or to assess baseline, seems to limit adherence!

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FORMAL APPROACH TO GE

- Minimum of 4, up to 10
- Have them organize from most threatening to least
- Start with one somewhere in the middle/high end – need some discomfort but also some odds of success
- For most it is walking
- Break them into chunks!
- Have them make a chart and visually follow it
- Needs cognitive/emotion/physical integration
  - Present an experiment question – what do you think will happen? Let's test it!

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Putting it all together

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DYNAMIC PRINCIPLES

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WHAT'S YOUR STORY?

Peter O'Sullivan

66

BE THERE

- Presence, listening, empathy
- This is the hardest skilled for any of us to learn but one of the most powerful
- We're not comfortable doing this, but we absolutely have to get better at this
- Listening and allowing their life story to unravel through education on pain is vital
- Often doing nothing but truly/deeply listening is the best thing you can do
- Giving tangible evidence-based hope
- Therapeutic alliance is most powerful intervention on the planet

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EVALUATION IS TREATMENT

- Treatment starts at the evaluation – the evaluation is treatment!
- Most thorough eval possible but graded based on sensitivity – If they don't move or you can't move it with tons of pain behavior your aren't going to get anything useful – Hence the Too Hot to Handle Tool Chest!
- Evaluation is therapeutic staging – Reviewing medications with patient is therapeutic, it's an immense opportunity for good quality neuroscience education!
- Without fail, reflexes every eval! no matter what, they are vital in education
  - "Your reflexes look very normal they reflect nothing serious going on!"
  - Higher Reflexes "Look how good your alarm system is"
  - Lower reflexes but symmetrical "Well those are pretty chill aren't they"
  - Most of us didn't get much exposure to this in clinicals and didn't get into a habit to experience these, there is a degree of "normal clonus" and even Babinski presence which has to be taken into context of the clinical picture
- AROM Neurodynamic screens for even Too Hot Too Handle – just gives you something to go on

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EVALUATION CONT

- Give them time to tell their story – get more details, vital to your education for them
- Their story becomes their POC
- Have a plan for one thing they have to bring back next time
- Ask what they did before
- Try and avoid what they did before, or if it still makes sense in their POC, you must thoroughly reframe it under pain biology for it to help
  - I've had patients completely admit that they had the same exercise before but it was until the explanation was in pain biology did it make sense why they should do it and motivated them to want to do it
- ***Gather yellow flags throughout the subjective – these guide your treatment!***

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RULE OUT RED FLAGS!

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PHYSICAL EXAM

What do painful AROM/PROM, resisted/combined movements, "special" tests and "tissue" tests tell you?

They tell you where it hurts – NOTHING MORE

"A fundamental reasoning error may be made by labeling a tissue as faulty on the basis that passive (or active) manual testing and other assessment techniques can reproduce the patient's pain. The reasoning error is to assume that the sensitive tissue evoking pain on mechanical testing is responsible for the pain rather than a reflection of the sensitized state of the nervous system." – Louis Gifford

Thanks to Nick Hannah for this summary

71

THE "SENSITIVE" PATIENT

- It is not uncommon to have a person whose nervous system allows no physical interaction
- This is their physiology, NOT THEM, many these were type A personality who pushed too far!
- ISPI/EIM has a great course called "Too hot to handle" and goes into this with great depth
- A few notes on the evaluation for a patient who is THTH
  - Prompt them, I know you have been poked/prodded and testing 100s of times before, I will make this as quick and as I can and I know I'm going to make you a little sore while I do it but I won't do this in your treatment! I must have some basics to make sure you are even appropriate for my care right now, things do get missed!
  - No value in provocation tests, everything hurts!
  - Don't get distracted with new localized pains – Pains will migrate – Pt. example with all the "tendinitis" – they're not doing anything repetitive!!!! Nosy neighbors!

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TREATMENT PLANNING

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A BASIC ROAD TO RECOVERY

Injury

Remember: Tissues Heal! With or without you

"Calm shit down"- Greg Lehman
Address Acute pain and reduction in environmental limiters of healing via: Somatic-Autonomic-Psychosocial Interventions (SAPI)

"Build shit up" – Greg Lehman
Improve loading capacity progressively and with concurrent SAPI
Resiliency of the body, mind, and emotions!

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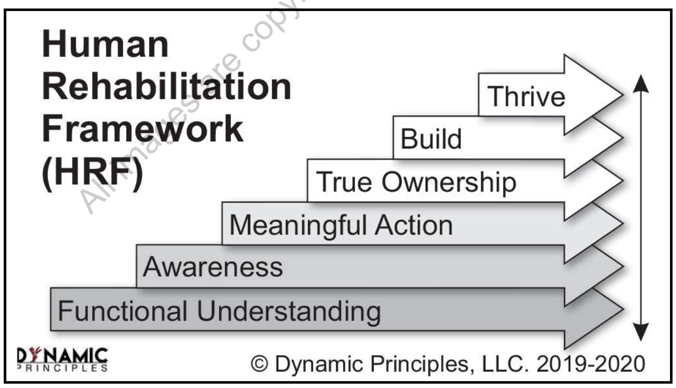

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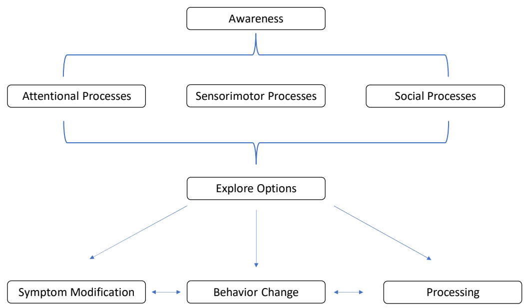

DYNAMIC PRINCIPLES

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Symptom modification? GET SAPI!

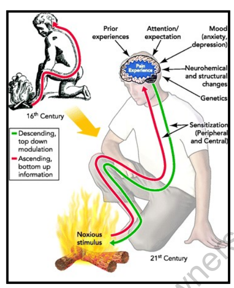
Somatic-Autonomic-Psychosocial Interventions (SAPI)

Top Down

- EDUCATION! - Before, during, after
  - Change the narrative TNE & BPS stories/analogies!
- Graded Motor Imagery
- Sleep
- Breathing/Relaxation
- Pacing
- Psychosocial Strategies
  - ACT/CBT/Mindfulness/EMDR
  - Referral as appropriate

Bottom Up (Outside In)

- Movement & Exercise
- Neurodynamics
- Manual Therapy
- Sensory discrimination
- Modalities – ESTIM/Ultrafix-it
- Orthotics/bracing/tape
- Pharmacology/Procedures
- Surgery



Bingel, U., & Tracy, I. Imaging CNS Modulation of Pain in Humans. *Physiology,* 2008; 23(6), 371-380.

77

Remember:
Symptom modification likely does not occur for the reasons we typically think

Likely many biopsychosocial processes that are present in the "outcome" of an intervention

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Choose Symptom Modification Carefully!

- Passive approaches and modalities (US/estim, needles, BFR, etc.) in addition to "shiny objects" may produce short and medium change improvements, but if you fully engage in core behavior change processes you are more likely to drive sustainable change and improvement in quality of life.
- "It might feel good, but it doesn't live well" – Steven Hayes
- "If you fix them, you could break them" – LVG
- If you explain a technique as symptom modifying and keep modifying symptoms where will that get you in the long term?

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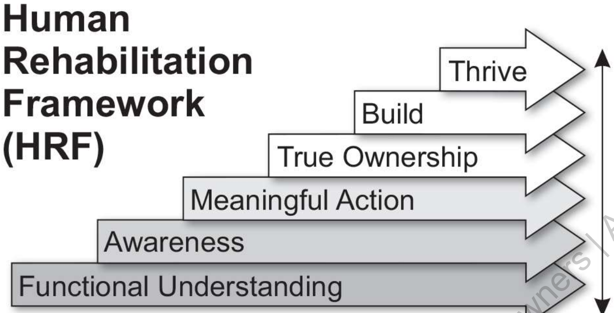
Human Rehabilitation Framework (HRF)



DYNAMIC PRINCIPLES

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The attempts to recover

DYNAMIC PRINCIPLES

- Primary care – X-ray & MRI
- Chiropractor – X-ray
- Physical Therapy x 3
  - MDT/Mckenzie
  - Different core exercises are every PT – *Each one telling the other exercises were either wrong or not enough*
  - Regional interdependence manual therapy/MET/manipulation/self mobs
  - Posture education and emphasis on "protecting spine" with neutral spine in lifting/bending
- Orthopedic Spine Surgeon – Additional X-Ray & MRI
- Pain Specialty Anesthesiologist
  - ESI x 2
  - RFA x 1
- Self efforts
  - Stretches & mobility work
  - More core
  - Back braces
  - Protect his back from strain

7 Providers!

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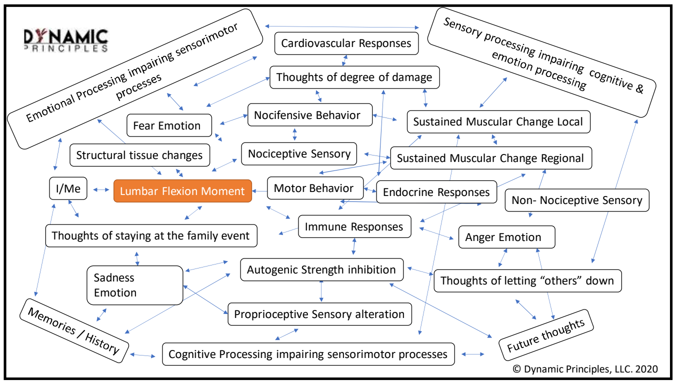
DYNAMIC PRINCIPLES
Emotional Processing impairing sensorimotor processes
Cardiovascular Responses
Sensory processing impairing cognitive & emotion processing
Thoughts of degree of damage
Fear Emotion
Nocifensive Behavior
Sustained Muscular Change Local
Structural tissue changes
Nociceptive Sensory
Sustained Muscular Change Regional
I/Me
Lumbar Flexion Moment
Motor Behavior
Endocrine Responses
Non- Nociceptive Sensory
Thoughts of staying at the family event
Immune Responses
Anger Emotion
Sadness Emotion
Autogenic Strength inhibition
Thoughts of letting “others” down
Memories / History
Proprioceptive Sensory alteration
Future thoughts
Cognitive Processing impairing sensorimotor processes
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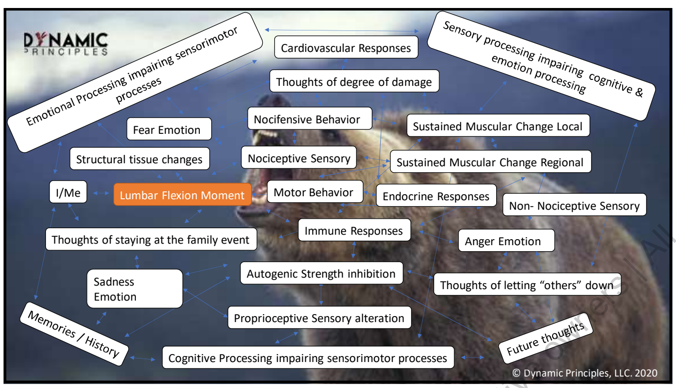
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Autogenic Strength inhibition
Thoughts of letting “others” down
Memories / History
Proprioceptive Sensory alteration
Future thoughts
Cognitive Processing impairing sensorimotor processes
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DYNAMIC PRINCIPLES
Lumbar Flexion Moment
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John's Recovery Journey

Evaluation Measures – Summary of measurable outcomes

- *4 years after initial onset*
  - Patient Specific Functional Scale: Overall=3.75
  - Sitting=5/10
  - Bending=3/10
  - Standing=5/10
  - Lifting from ground=2/10
  - Modified Oswestry Low Back Pain: 28%- Moderate
  - Pain: Current=3, Worst=7, Best=3

Plan of Care
Biopsychosocial Process based approach – Human Rehabilitation Framework (HRF)

- Context Based – Function specific (Sitting, bending, standing, lifting)
- Integration of thoughts and emotions related to movement and pain.
- No stretching/mobility, no core exercises, no postural corrections, no directional preference.
- Reframing and self exploration of exercise routine for self guided return by week 2.

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John's Recovery Journey

Plan of Care
Biopsychosocial Process based approach – Human Rehabilitation Framework (HRF)

- Context Based – Function specific (Sitting, bending, standing, lifting)
- Integration of thoughts and emotions related to movement and pain.
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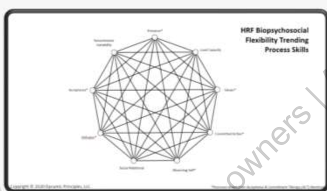
- Reframing and self exploration of exercise routine for self guided return by week 2.



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John's Recovery Journey

<u>Total Client Sessions: 5 sessions over 5 weeks</u>

Final In-Session Measures

- Patient Specific Functional Scale: Overall=8.75
  - MCID = 2.2 / John's change = 5
- Sitting=9/10
- Bending=8/10
- Standing=10/10
- Lifting from ground=8/10
- Modified Oswestry Low Back Pain: 2%
  - MCID = 12% - Johns change =26%
- Pain: Current=0, Worst=3, Best=0

Follow-ups by phone email 3, 6, 12 months later

- 1 Flare-up, self-managed, return to weightlifting, confident can maintain ongoing.
- Reports "he gets it" sees how "everything" plays into his movement and pain and how he is able to take care of it himself.
- Feels he has his life back.

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Confident Ambiguity

The absolute, "this tissue/disease is the issue", which is both culturally and healthcare driven, is why we are in a chronic pain epidemic. When it comes to pain and movement, physical medicine and rehabilitation professionals need to come to terms with the complexity of pain. It is never a single factor, even if there is a single predominant source of nociception. This also holds true for acute injury, you must account the environmental factors and the processing, as well as the outputs, and embrace the unknowns.

This understanding makes pain and movement complicated; it makes things a bit gray, there is no absolute. You must make a clinical decision to guide the treatment, you need to be able to identify red flags quickly, you need to identify some important "tissue" issues, but you also must be able to confidently proceed with fair degree of uncertainty with a great deal of grace and skill.

DYNAMIC PRINCIPLES

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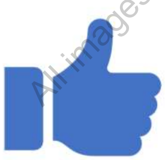

IF YOU GOT SOMETHING USEFUL FROM THIS CLASS:

TELL A COLLEAGUE AND LIKE DYNAMIC PRINCIPLES ON SOCIAL MEDIA!

REVIEWS ARE ESSENTIAL TO SHARE THIS MESSAGE!

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QUESTIONS?

DYNAMIC PRINCIPLES

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Lab - Graded Exposure and Graded Activity

General Thoughts

- Disability outpaces pain
- “The nervous system can be like a spoiled child, you can’t just feed it candy all the time” – Jo Nijs
- Graded exposure is NOT the same as graded activity or exercise
- Graded exposure is context oriented physical/cognitive/emotional exposure to an activity, typically for fear avoidance beliefs of an activity
  - An interactive process of creating an experiment for the client and gradually increasing the scope of that experiment
- Graded Activity these people are deconditioned-They have LOW LOAD CAPACITY!
  - Aerobic plan begins day 1 or day 2!!
  - MUST be independent – don’t waste time in your session unless needed to demonstrate ability or to assess baseline, seems to limit adherence!
- Focus on success, not failure
- Regarding resistance training and aerobic training plus specific exercise prescription
  - “We are building comprehensive loading capacity!”
- Graded Exposure and Graded Activity
  - DRAW OUT THE PLAN!
    - They need to cross off each day they complete so they can see where they came from and where they are going
  - “arthritic” joints need exposure – education education education! Don’t get distracted with desensitizing joints and body parts, they need to start gravity dependent movement as quick as possible in the smallest chunk possible, small but consistent goal oriented graded exposure. They can do unloaded work (pool or DEMS) as adjunct for higher volume but they need to be doing SOMETHING specific to the area they struggle with on land!
- Grade exposure with exercises – Use the exercises you know to tweak a movement in pieces and parts to allow them to do the full functional movement easier – Don’t take too long!
- Grade Exposure and manual therapy – Look back at sensitivity from eval, can you move the joint segmentally, has the tolerance improved – Don’t get too caught up in this, but know it can be valuable for some

- Persistence, Pacing, and "Power Naps"
    - Don't forget boom/crash – Still need ADL pacing and increased rest, just need concurrent graded exposure!

Creating a Graded Exposure Experiment

1. Ask your client to list 5-10 activities that they don't want to do due to fear of injury or pain
2. Have them rate those activities from 1-5 or 1-10 depending on the number you come up with together
3. Selected 1 activity that they rank between 6 to 7 – You can do more than 1 activity but depends on overlap and overall sensitivity
4. Ask them to imagine and describe what would happen if they did this activity
5. Ask them if they are willing to trial the activity
6. Modify based on fears and mutual discussions regarding this activity
7. Find an entry point they are willing to trial
    a. To be discuss later – where could manual therapy help here?
8. Test the experiment
9. Develop a plan to frequently expose to this activity with a set goal based on their Loading Capacity (see graded activity below)
    a. "No more, no less!" they must stick to the plan as a dedicated time
10. Once goal is met, revisit the activity list and see if it has changed and start the process again

Created a Graded Activity Plan

1. Review all the factors of Loading Capacity for the areas of concern of the client
2. Decided between a linear loading plan or an interval loading plan
    a. This is based in part on their history with possible failure with returning to this activity before
3. If a linear plan, start low and slow and build low and slow
    a. Think Barbecue – "Low and slow"
4. If interval plan
    a. The sky is the limit regarding rounds/duration/intensity
    b. Rest period based on energy systems – 3 minutes is good ballpark, but in depending on physiology alterations from central sensitization may need up to 5 minutes
    c. Essentials of Strength and Conditioning is a good reference for understanding energy systems – just scale up for sensitization

Notes on Graded Activity

- Vast majority who say they can't move when prompted can come up with something they can do for 10 minutes, if not, graded exposure until they can get to 10 minutes!
    - Start with giving them options: Walk, Bike, Swim, or other continuous activity like the elliptical
- Write by hand this plan every time:
    - Duration: 10-30 minutes (minimum and max unless their goal is to do a sporting event!!)
    - Frequency: 4-5 days a week (could start at 3 if recovery is poor)
    - Heart Rate: 100-105 bpm (20% increase if they have tachycardia)
- Educate on "plumbing" – Talk about building new blood vessels to feed the nerves not just with activity, but at rest, "it's like there is a bypass for the nerves of your butt!"
- Emphasis this takes time, 6-8 weeks! Body response to "consistent physical stress with a SUSTAINED duration"
- You must be CLEAR by definitions. They will report they already move all day long, they get 10k steps, but they rarely get 10 minutes of CONTINUOUS activity
    - Even day laborers will find when you give them these details that they are doing intermittent anaerobic training throughout the day and RARELY get 10 minutes of continuous activity
- Feed the nerves, BLOOD/MOVEMENT/SPACE, but also can talk about the "pharmacy in the brain", built in chemistry 400x more powerful than morphine!
- Have them help you estimate their rest
- Underestimate but insure some effort/discomfort is involved, use the 0-10 scale, needs to be to be between 6-7 challenge, "Sore but safe!"
- "No more, no less!" they must stick to the plan as a dedicated time

White Board Examples

- Walking
- Bending/Twisting
    - Bending and twisting – Big fears, mostly due to poor education before!
        - SLOW AND STEADY VOLUME (2 reps x 3-5 rounds to start!)
        - Relaxed, easy, faster movement
        - "The longer and more careful you do this, the more you are working, this is harder and tiring for your muscles"
        - "It's like a band aid, you just gotta rip it off, it may be excruciating for a moment but typically it doesn't linger too long!!"

Small Group Topics

- Return to running
- Cleaning a kitchen
- Returning to deadlifting
- Sitting in an office chair
    - Need to expose subacute discs slowly to sitting, "Your nerves need to be 'ok' with a little lack of blood flow as well, we need the nerve sensors to be a little less excited about sitting!"
- Returning to pitching

DYNAMIC PRINCIPLES

Lab - Graded Motor Imagery

General Thoughts

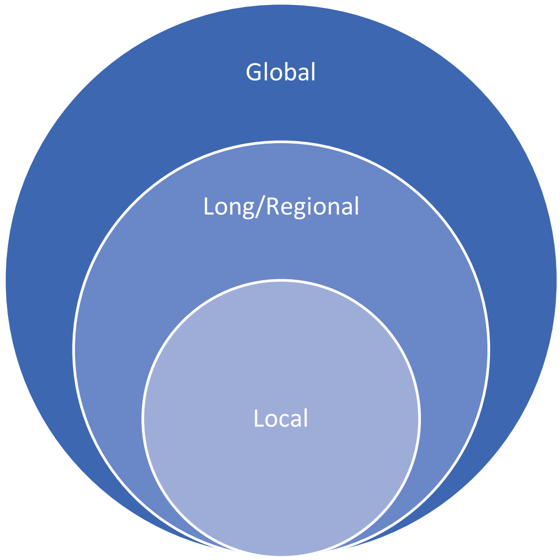
- Too much to cover in this course – Just some examples
- Remember scale of sensitivity
- Creativity is king

Lab Session Applications

- NOI Recognize App
- Flash Cards
- Magazines
- Guiding a Visualization
- Mirrors
- Virtual Reality

Lab - Interacting with the Nervous System

Organizational Framework for interacting with the Nervous System



Global

- 45 miles of LIVING continuous 'multipurpose' wire AND plumbing!
- Systemic States – Cardiovascular, Immune, Endocrine, etc.
  - Any compromises and multi-system interactions– Particularly consider disease and medications
    - Immune – Local vs neuro-immune pathways
    - Cardiovascular – Poor plumbing does not make for a happy nervous system vs ANS influence on CVS
  - How conditioned are they?
    - Aerobic
    - Anaerobic
  - Endocrine Stress Biology
    - Sympathetic/Parasympathetic
    - What's going on in life and how do they manage it
    - History of trauma
      - Trauma is broad and not everyone responds to trauma the same way
  - Cognitive influence
    - Language alters physiology of nervous system
  - Other?

Long/Regional

- Mechanical/positioning/behavioral properties of 45 miles of continuous living multipurpose wire and plumbing
- Remember ion channel variation, intraneural/axonal blood and fluid pressure, postural influence, etc.
- Paresthesia needs to be normalized quickly – "Just a change in blood flow or a change in awareness of blood flow"
    - Yes, concurrent with pathologies but only because of the pathologies interaction with the nervous system!
- Clinically important for consideration for:
    - Injection
    - Stretch vs. compression vs. chemo vs. anoxia tolerance vs thermal
- Convergence Properties
    - Einsteinian and Newtonian Physics - Shacklock
    - T-Band Nerve Example
        - Equal and opposite does not move, unequal it moves
        - Ulnar example
            - Elbow Flexion vs wrist - Variable response based on variability in interfaces
            - Helpful for graded exposure progression
    - Slump example
        - Sliding Problems – Rare
            - Upward Sliding 'Sensitivity' (dysfunction – Shacklock) – "Overhook - McGill"
                - Neck flexion and knee flexion
            - Downward Sliding 'Sensitivity' (dysfunction – Shacklock) – "Underhook - McGill"
                - Neck extension and knee extension
- Regions of the wiring can be emphasized effectively
    - Full length
        - Slump
            - Segmental flexion
            - Slump, standing flexion, mindful childs pose
            - Sidelying thoracic mobilization
            - Lateral glides for thoracic rami
        - Contralateral influences upper vs. lower
            - T-band example for symptomatic nerve root to use contralateral nerve root
                - Contralateral lowers cord and approximates the root
                - Graded exposure to restore

- Upper Quadrant
  - Large amplitude oscillatory techniques such as brachial plexus are great!
    - Median
    - Ulnar
    - Radial
    - Upper contributions to the OA region
- Lower Quadrant
  - Sciatic
    - Tibial
    - Peroneal/fibular
  - Femoral
    - Pure
    - Lateral Femoral Cutaneous

- Recovery positions
  - Reminder – Flexion reduces on average 53% pressure on nerve root regardless of nucleus migration – Schmid et al.
  - Lower Quadrant
  - Upper Quadrant
    - Have to get over pathoanatomic beliefs about 'Impingement' and joint packing
    - Acute cervical radiculopathy shoulder sling tape job
    - The cervical OVER flexion opening strategy for sleep
      - Your acute nerve root folks will thank you!

Local

- All that stress and special tests that provoke 'pain' demonstrate is that the region involved is sensitized!
  - For you to feel an area, you need mechano/chemo/thermal ion channels
  - No test that provokes is specific to tissue, only toward possible sensitization of the region
- Apply this daily!
  - Injury/strain – what nerve fibers in the region? What possible ion channels firing right now? Follow it proximally, what tissues does it travel through?
    - Can you kitchen sink it in treatment?
  - Think what information is being processes in this experience? Don't forget vision and sound!
    - Crepitus! -Noise is scary – movement avoidance

- Joints and Neurodynamics:
  - Hip capsule is innervated by the femoral n., sciatic n., and obturator n.
  - Glenohumeral capsule by C5/C6 and brachial plexus (suprascapular and axillary n)
  - Knee capsule by femoral n., saphenous n., sciatic n
  - Facets by medial branch of their respective dorsal rami
- It is more than the long nerves, you can follow the trail to the capsule and beyond
- Clinically important for consideration for:
  - Injection
  - Stretch vs. compression vs. chemo vs. anoxia tolerance vs thermal
  - Desensitization vs graded exposure – Do you focus on calming the joint or overall system, or do you progressively build from what can be tolerated? Or both?
  - Do you just warm the joint up and load the crap out of it to tolerance or do you bring it down first?

- Freedom from fear with manual therapy, just don't harm the neurovascular structure! (excessive stretch or complete occlusion for extensive time or traumatic techniques)
- More in manual therapy lab!

Lab Examples

Dissect an upper quadrant neurodynamic test and technique

- How do you emphasize elbow? Shoulder? Neck?
  - If one of these are sore but you want to move the long distribution, how could you change the technique?

Find a recovery position for neuropathic pain

- Upper quarter
- Lower quarter

Trace the distributions which may help to modulate the following acute "tissue" injuries

- Lateral ankle sprain
- Medial knee pain
- A/C Joint sprain
- Lateral epicondylitis

Large and Small Group - Dermoneuromodulation

- Delightfully simple and immensely empowering, yet shockingly complex in physiology
- You've been dermoneuromodulating your whole career and never knew it!
  - Skin is the outside of the brain – fastest way there
  - Kinesthetic/proprioceptive sense
  - Lightest/gentlest effort possible
  - Touch, tape, movement
  - PPT and/or tone change example time dependent

Lab - Language Change

General Thoughts

- Countless resources – We can barely touch the surface here, you need multiple stories and approaches to education to be effective – there is no ONE way of teaching and talking
- Be present and aware at all times

What's your story?

It ALWAYS begins with the question: "What is your story?"

- Until you know about their history, reported UNINTERRUPTED, you cannot know where they might have fears and/or knowledge gaps
- Let them go until they stop. You can get enough to fill out your "objective" information with just a few tests to bill for the evaluation if you run out of time. It is more important to get to know the person, their fears, hopes, and frustrations, what do they really want to do? Pain sometimes is a very small piece it is just associated with their disability.
- Record Yellow Flags while listening:
    - IE: My arthritis, my discs, my 'knots", damage, injury from 1963, I'm broken, by spine, I'm unstable, I'm not strong enough, my core is weak
    - Be aware of: "I just want to be fixed, can you fix me" – do not feed them a 'FIX', it only worsens their outcomes in the long term. Modifying symptoms is fine and has a place but they need to see the long picture first
- You must have permission to educate
    - "It sounds like you have been through an awful lot and are clearly struggling, there is some new thinking regarding challenges similar to yours, are you interested in learning about it?"
- More specifics
    - Are they non-interactive?
        - "It must have taken a lot of effort for you to come out here, your time is very important, was there anything you were hoping to get from me today that I could get to right away?"
        - Do you think I am someone who can help you with your problem?
            - Why or why not?
            - If not, do you think that if you can move around a little easier in the day and do a little more, would that be helpful to you?
        - Ask them if they have had a bad experience with PT/AT/OT before and what worries them about this?

    - "If I could take your pain away completely right now, what would that mean for you?"
    - "Why do you think you hurt?"
    - **There are many factors beyond your control and knowing when to cut the evaluation short for both of your sake is GOOD clinical decision making!**
  - Are they skeptical?
    - Try and shift them, humor and empathy
      - "I can see I'm intruding on your time, let's get this over with for the both of us!"
      - "They told you I'm really good at this stuff? Man, they should get into car sales, I'm a lemon!"
    - "Why do you think you hurt?" – Use this to determine your education but wait until after the evaluation to deploy the education!
    - Have your charts and pictures ready – They need the data and they need detailed explanations!
  - LISTEN Carefully to their word choice: Use their words during stories and evaluations:
    - "Flu like" "My whole-body hurts"
      - Great immune and "nosy neighbors" story lead in!!
    - "Feel like 90 years old"
      - Great connection to "stiffness" story in movement output
    - "It keeps moving, switching sides, up and down, I feel crazy!"
      - "Nosy neighbors", 45 miles of continuous wire, immune system, homunculus, show pictures of fMRI
    - "I feel 'unstable', my bones are bad, my nerves are pinches, my disc is bulging, I'm out of whack, my spine is crumbling, my body is damaged, I'm so tight all the time, I just feel like I need to stretch it non-stop, no one can make the "knots" in my muscles go away"
      - It's like they are telling you what to teach them!!
    - "Some days I can't get out of bed"
      - Perfect education on boom/crash/pacing and chemical soup!
    - "I don't know what's going on"
      - It's your lucky day!! Emphasize how knowledge is valuable for effective pain treatment – You are so safe, your alarm system is so good, you could not possibly injure yourself with your own movements! We still must avoid boom crash!

- Placebo Talk – Stop making it bad, you can even call it placebo, if it seems beneficial to the patient, it may help!
  - Large amount of research is now on enhancing placebo effect in clinical treatment!
  - Therapeutic Staging

Fibromyalgia

If they have a dx of “Fibromyalgia” - Ask them what “Fibromyalgia” means to them, tell them that the good thing about the word has been that it has validate their symptoms in the medical world. The downside of the diagnosis is that it tells them nothing about the complexity of what is going on, that this is a biologic process called Central Sensitization, which is not a diagnosis but a process by which the body protects itself, which can result in a wide variety of symptoms they have. It is the process of the body’s alarm system being overly protective! Write the word for them, they will Google it and this is a good thing for once, it’s hard to find crap about it!!

Every time they use the term “Fibro” you must reinforce what does that mean and that it is worthwhile for them to change that phrase to something more meaningful whether it be “my alarm system is tuned up too loud”, or “my bucket is overflowing”, or if they are super technical then just have them call it central sensitization!!

  - This is a continuous re-education process, they don’t even think about it when they say it. You must break the process, leaving “Fibro” as a mythical thing leaves little room for them to look to improve on their situation and work with their body rather than against it.

Don’t over promise

- You are not a healer or fixer
- Don’t oversell the magic symptom modifier!! If they get immediate improvement, make sure you warn them of possible return or even flare-up
- Your body has been building these protection strategies for years and multiple systems of your body are involved in keeping these strategies alive. We can improve it, but flare-ups and ebs and flows are normal, the goal is the trend for continued improvement in function and decreased symptoms
- “I can’t promise you it will be gone, it’s a bucket, it’s still got stuff in it, it will never be completely drained but sometimes it’s like there is nothing in it at all. Miracles do happen, but I can’t promise you that it will be 100% gone. I can promise you this does get better, you will do more, and you will do it with less pain!” – Give them a copy of the “what you expect” vs” what it’s really like” and keep going back to the MOM and the bucket analogy

Acute Reminder

- Whiplash Example

- Immune system and endocrine wind up takes up to 10 days – might be fine and then *BAM!* Horrendous symptoms out of the blue
- As little as 2 weeks for notable central sensitization changes for OA-C3 insult
- Profound sensory neuron changes with cervical dizziness and HA over time

- They will forget, remember, nothing in their life is reinforcing what you are teaching them, you must make your words echo in their mind, over and over again

Chemical Soup Flare-up

- Teach this early and often, again as much as 10 days after a "stressor" can result in symptoms randomly
- Typically, onset within minutes up to 3 days and duration of 3-14 days on average – Bell-shaped curve always leaves room for anything
- Chemical soup can be any triggered by physical, mental, emotional, or any such combination, stressor

Know your stuff!

- Healthcare professionals who suffer from widespread pain are particularly freaked out, they know dermatomes don't work that way! – Nosy Neighbors!
- Know your stuff, very technically, both for creating simpler analogies but to not be shocked when a patient recites gate theory, nerve pathways, and most the tissues of their body! Many of these patients are smarter than the average PT/AT/OT! Be ready for challenging questions!

Words have lasting effects, a significant portion of chronic pain and disability is rooted in beliefs and previous clinician education, the best treatment is prevention!

This is extremely hard, especially the longer you have practiced, don't beat yourself up and don't beat up your colleagues but kindly reinforce and help each other improve

Nocebo Alternatives

Basic Rule of Thumb – If your language and your explanation of their condition, or what you are doing, does not yield a positive spin on something scary, change what you are saying and discuss with your colleagues how to better explain a finding or treatment with less threat. Re-assure them that the human body is strong, resilient, and adaptable!

During your assessment re-affirm findings of health and capacity and describe impairments in the least threatening manner possible, they are not bad, they just are what they are, and we'll play with helping them improve on these findings!

Valuable Mantras

Blood, movement, space! – Consider this a mantra of all things therapy, nerves and joints (maybe fluids for joints)!
Tissues heal! – With or without therapy
Motion is lotion!
Sore but safe!
Don't freak out over flare-ups!
How do you eat an elephant?
You are strong, resilient, and adaptable

Specific Language Ideas:

Arthritis	WEAR & REPAIR! Since your body is building more bone your joint/spine has a less space to work with, it can move less and get sore from time to time, let's try and make it less sensitive and move easier. When it flares up – "It's like it's an active construction site, lots of workers around making the joint a bit irritable and sometimes hot and puff" When there are osteophytes – "It's like a construction truck got stuck on the way to the site, might be picked up at some point or it will be moved out of the way!" "Gray Hair Inside of the body" normal age-related changes / etc.
Wear and Tear	WEAR AND REPAIR! "Gray Hair Inside of the body" / normal age-related changes
Degeneration	Your body is conserving space and materials as it gets older, it's easier for it to manage a joint if it's not moving as much. For tendons, just some old materials laying around, your body will build new

	healthy tissues around it to improve your function. "Gray Hair Inside of the body"/ normal age-related changes / Your joint/spine has a less space to work with, let's try and make it less sensitive
When joint needs to be replaced	Terms like worn down/pinching are not helpful, describe less threatening – Your joint space is a smaller, it's harder for the joint to move around and it seems like we've gotten to the point that your body say it doesn't want to work around the lack of space anymore, you do too much in that small space and it's yelling at you quicker and quicker. Getting a new joint with some more space is going to help, we'll be here to help you learn how to use that new joint to its fullest after you get it!
Instability	Deconditioned, sensitive to movement, protection pattern/behavior related to pain or movement change
Stabilization Exercises	Avoid term as much as possible, this has shown up repeatedly in research as patients feeling less confident in their body's when described this way. "Core exercise" is ok if it doesn't give the sense that it's preventing them from falling apart, Conditioning, getting you better in shape, working all the muscles around the area to take on physical challenges – We are building "comprehensive loading capacity" not trying to keep the body together. Education on the power of isometrics on pain – bracing/holding muscles can be like a dose of pain medication – Avoid the thoughts that they are protecting their spine with bracing/core exercises – Biomechanics research clearly demonstrates the opposite..
Disc Bulge	**With extremity pain**: It might be taking up a little space but we know that over the course of a year they naturally come and go, they're only a problem if by not letting the nerve breath they cause major nerve changes like muscle weakness or we've given it a good PT it's not changing at all, remember it takes a good 6 months go through it's natural course and sensitive nerve roots can take up to 3 years! **Without Extremity pain** but an MRI revealed a disc bulge and they report back pain: Give them the research graphs and explain disc bulges do not related with back pain at all and any back

	pain that might have occurred with an acute disc has to do with the chemical soup of the process of the disc bulge (*FYI not necessarily the pt. it's the end plate 'modic' changes that may have resulted in the sinuvertertebral nerve becoming sensitive, the disc doesn't matter*)
Out of alignment/out of whack	You're a little stiff here, it's hard for you to move there, let's try this technique. | Your body might be holding you in a way it thinks protects you better, or you might feel like something off but it's because your brain might be a little confused about it, we'll do this technique to make it think a little different about the situation and maybe if it's holding you a little off it'll let go and feel more comfortable. Let's try and change the body's behavior, it seems to be overly protective and might not know what it feels to be at ease!
Leg Length/hips are off	Humans grow like trees, they don't grow straight, symmetrical leg length is an abnormal human trait, most people have leg length differences. | Your body may or may not be holding you in a way it thinks protects you better, or you might feel like something off but it's because your brain might be a little confused about it, we'll do this technique to make it think a little different about the situation and maybe if it's holding you a little off it'll let go and feel more comfortable
Pinched Nerve	Nerves are designed to be pinched! They only have problems with pressure if they are made sensitive due to chemicals irritating them or they aren't being given enough intentional blood/movement/space. Let's try a few things to feed the nerve and make it happy!
Tear/torn/ripped	TISSUES HEAL! First, verify the timeline, if it has been past the timeline of healing, you must educate that it is healed, re-assure that even scar tissue is healthy tissue and it is healed well but likely the tissues are sensitive and not used to loading, you will help them get it used to loading! If it is acute injury, use "strained" vs. tear/torn/ripped and give them a predictive time and tell them you will help with pain and the progressive loading plan. Remind them tissues heal, with or without intervention but making sure they don't become sensitive after the healing completes is what you are there for!

"Keep Being Reinjured"	TISSUES HEAL! Education on flare-ups and predictable timelines, "sore but safe", remind them the body is resilient and unless very acute or a severe traumatic event had occurred, their odds of re-injury is very low but the odds of their alarm system being overly protective is very high.
Swelling	Healing soup - look at what a good healer you are!
Inflamed	Cranky/irritable rather than inflamed, active construction site analogy
Inflamed OA Joint	It gets cranky if you force it to move to much or too far, but man look at how good of a healer you are! Active construction site analogy
Posture	This is a very personal thing for many patients, they feel like failures because they cannot maintain a so called "Good" posture. If you ask most patients, almost all of them will say they have bad posture or they're trying to work on their posture. Remind them there is no such thing as "good posture", only a posture of ease that needs changing which we can help them with finding. Many are fearful of lumbar slouching and hold tension at rest while sitting and in laying which contributes to their chronicity, remove the fear of slouching! In addition, sometimes modifying a posture or joint position can be used as a relieving strategy, this does not inherently mean they should keep those postures forever!

Lab - Manual Therapy Language

Biopsychosocial Application of Manual Therapy – Moving beyond Symptom Modification

"An important role of human body behavior is to protect itself, in particular the health of the nervous system, a somewhat important system that sustains conscious human existence, which has physical, cognitive, and emotional layers attached to it. It is likely not helpful to label these protective behaviors as bad or good, but to recognize in some circumstances that these protective behaviors may begin to limit function. Many times, movement and physical behaviors of the body are perceived as part of the musculoskeletal system alone, however cognitive and emotional states, which are intricately bound to social/cultural demands and expectations, also influence body behaviors, including postural and ideomotor tendencies that could manifest as protective strategies of the human body. Some of these protective behaviors may limit movement and movement variability and this could be sensitizing to the peripheral nervous system because nerves might not be experiencing adequate blood/movement/space and possible noxious mechanical deformation. While the goal should always be to have the client independently explore variability and quality of movement, sometimes they simply can't find the area of their body to move, have poor sensorimotor awareness and coordination, and generally have difficulty creating movement variability without some guided tactile input from another person. There is notable evidence in research that somatosensory neuroplastic reorganization is constant and that certain areas of the body are poorly mapped, such as the back/pelvis/hip. Furthermore, a sense of self is more than simply "where are the body parts", how humans see themselves via interoception has been recognized as an important component of their behavioral and emotional states. Lack of movement, movement invariability, and pain experienced with movement may result in changes of these body maps that make sensorimotor coordination challenging. Tactile input and tactile cues do not necessarily need to be considered "manual therapy", however, many traditionally taught manual therapy techniques can easily be "re-framed" in ways that could help someone to better "get to know their own body and behaviors" and influence somatosensory mapping and sensorimotor behavior through various forms for clinician "manual" input. I would argue that in our continued efforts to improve on the application of a biopsychosocial framework, we move beyond using manual therapy simply for "symptom modification", but rather helping a person to better understand their body and the behaviors it exhibits, not only in the clinical setting, but in broader biopsychosocial contexts. " – Leonard Van Gelder

Language Ideas

- **Soft tissue**
    - Myofascial Release
        - Dermoneuromodulation
        - Awareness and introducing variability for the unconscious autonomic behaviors
        - Mapping and sensory integration with directions of movement
    - "Trigger points"
        - Ischemic vs. dynamic
        - DNIC
        - Graded Exposure
    - ART or Functional Release
        - Great opportunity to incorporate active movement and meaning!
    - IASTM
        - "Painting the area for your brain"
    - Massage Techniques
        - Calming
        - Mapping

- **Joint Mobilization**
    - Graded exposure
    - Pre-movement
    - Directional awareness
    - Calming
    - Moving some fluids
    - "Joint jiggling"
    - Helping your body know this movement is ok and safe!

- **Joint Manipulation**
    - General inhibition with quick stretch
    - Noise integration – could be threatening or relieving
    - Graded exposure – speed dependent consideration of movement
        - Addressing fear?
            - Both clinician and client – Bodies are durable, noises are normal
                - Education on "suction cup" effect

- **Mulligan**
    - Great functional applications
    - Dermoneuromodulation
    - Graded exposure
    - Exploring movement variability
    - Things to play with – Ankle, lumbar, shoulder assisted elevation

- **Muscle Energy**
  - Let's talk SIJ!
    - Body awareness
    - Graded Exposure
    - Exploring movement variability
    - Assisting with lumbopelvic flexion dissociation

Red Flags Quick Screen

Blood Pressure

- For EVERY UQ pain if you are the first healthcare provider
- ALWAYS ask about BP meds and make time to check for them

Reflexes

- UQ
    - Biceps – C5/C6
    - Brachioradialis – C5/C6
    - Triceps – C7/C8
- LQ
    - Patellar – L3/L4
    - Achilles – L5/S1
- AIM for both UQ/LQ
- Time pinch - UQ for UQ Pain and LQ for LQ pain

Upper Motor Neuron Screen

- Babinski
- Hoffmans
- Clonus – Lots of normal occurrence of clonus, only concern is sustained or 4+ beats

Manipulation and Cervical Rotation Screen – Cranial Quick Screen

- Romberg - CNVIII
- Shoulder shrug - XI
- AROM Cervical rotation in sitting
    - Pupil Reaction – CNII
    - Convergence - CNIV
    - Vertical & horizontal - CN II/III/VI
    - Smile – VII
    - Face touch - V
    - Stick out tongue & swallow – VII, IX, & XII
    - Finger Rustle - CVIII
- CNI, X require significant vascular impairment, likely already functionally evident, you've got a better spread than most with 10 out of 12

Lab - Sensory Testing

Primary Tests

Dermatomes

A word about dermatomes – Current understanding of neurophysiology and dynamic nature of somatosensory cortex neuroplasticity dictates that dermatomes are not SET, they change regularly, you can only ball park relative distributions.

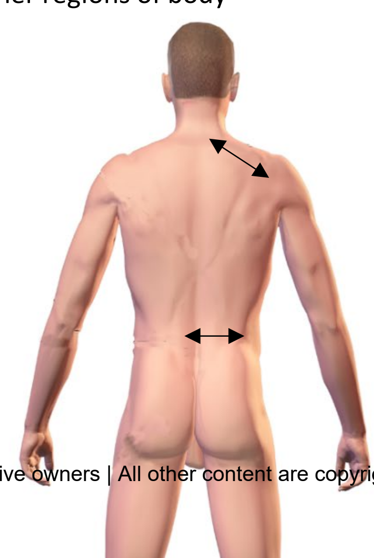
> *That being said, if your S1 dermatome overlaps with your C7 dermatome, you might have found a problem…*

Pain Pressure Thresholds

- Research is scattered but generally less than 6lbf (3kgf) is considered sensitive
  - Alqarni, Abdullah Mohammad, et al. "Test Procedures to Assess Somatosensory Abnormalities in Individuals with Peripheral Joint Pain: A Systematic Review of Psychometric Properties." *Pain Practice* (2018).
- My clinical experience is anything under 3lbf of pressure in any region of the body I would consider sensitive and less than 1lbf is very sensitive
- Most studies use 10 seconds x 3 rounds, clinically, generally I don't do more than 2 trials due to modulation and facilitation physiology from firm pressure
  - Unless you are attempting to test a form of summation…
- Always side to side comparison (±4lbf/2kgf considered important) - Algarni
- Do-It-Yourself Algometry Example
  - Johnson, T. W., and P. J. Watson. "An inexpensive, self-assembly pressure algometer." *Anaesthesia* 52.11 (1997): 1070-1072.

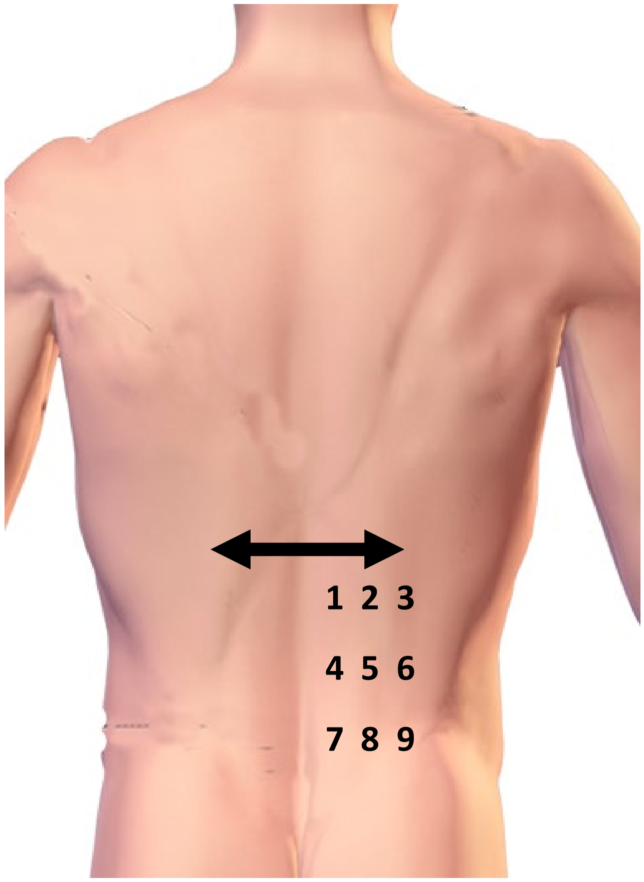
2-Point Discrimination

- 3 Trials on each side
- Can be vertical/horizontal/multiple directions – just look for consistent side-to-side CLEAR deviation
- Anything greater than 13mm horizontally and 17mm vertically different side-to-side would be a clear deviation – Wand et al.
- Lumbar and Upper Trapezius Example
  - 50mm +/- 11.74mm - Adamczyk et al
- Catley and Nolan for other regions of body



Localization

- Lumbar Example
    - Anything greater than 90% I consider normal – No norms –
    - Case example Louw et. al used whole back
    - Personal Preference – Side to side
    - Use markers and consider larger count (up to 12)



Mono-filament Temporal Summation

- Lateral ankle/foot peroneal n.
- Medial ankle/foot tibial/saphenous n.

Clinical Methods for Detecting Small Fiber Changes

- Sharp vs Dull
    - Some research shows tooth picks are adequate
    - Personal preference is Neurotips and a sharps container
    - Distal Extremities will be more profound than proximal
- Cold vs warm
    - Cold – any piece of room temperature metal
    - Warm – any area of patient arm or your arm that is at normal body temp

Vibration

- Range from 128-256hz – common in clinic
- What you're looking for:
  - Difference sides to side and provocation of concordant symptoms

Secondary Tests – Not covered here

Texture Discrimination

Temperature Discrimination

Pressure Discrimination

Graphesthesia

Letter/number/sentences

Stereognosis

Identifying shapes – periphery or even orally for mouth/jaw pain

Sound Discrimination

- Tones
- Music type impact on person
- Therapeutic Listening

Lab - Sensorimotor Experiences

Small Groups - AROM

Cervical

- Finding path of least resistance
- Integrating the neighbors
  - Rotation
  - Flexion/Extension

Shoulder

- Emphasizing regions – GH, GH + SCAP, SCAP on thoracic
- Combining regions
  - Forward flexion
  - Overhead reach
    - Rethinking the upper traps
    - What's their target?

Small Groups - Balance

- SLS standard with core
- SLS with ease

Demonstration - Kinesthesia via the skin

- Dermoneuromodulation preview
  - Use of KT tape
- Shoulder overhead assistance for flexion/abduction
- Cervical rotation
- Scapular slinging – Neurodynamics preview

Demonstration - Ideomotion

- Seated Example
- Supine arm

Lab – Movement Experiments

Movement with attention

- Walking
- Object hold
- Object pickup
  - Deadlift example
- Sit to stand/squatting
  - Barbell squat example
- Running
- Jumping

Context Driven Movement

- Sight, sound, smell, touch, taste
- Environment
- Meaning, beliefs, fears, motivation
- Internal vs External Cues
- Internal variability through awareness of tension

Strobe Glasses

- Balance
- Jog
- Object catch/throw
- General Movement

Virtual Reality

What now? What does this mean for exercise (movement) prescription for you in the clinic?

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Loading Capacity - Education and Application

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