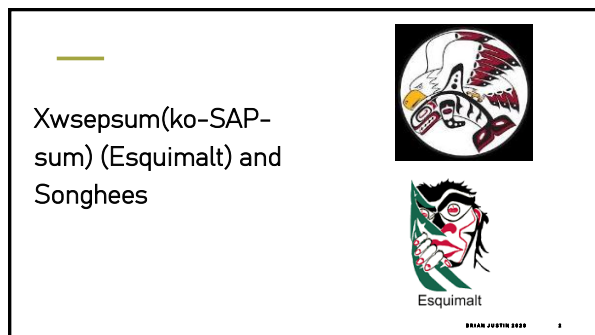
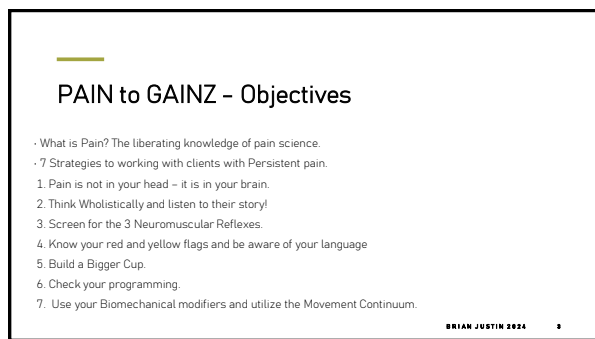




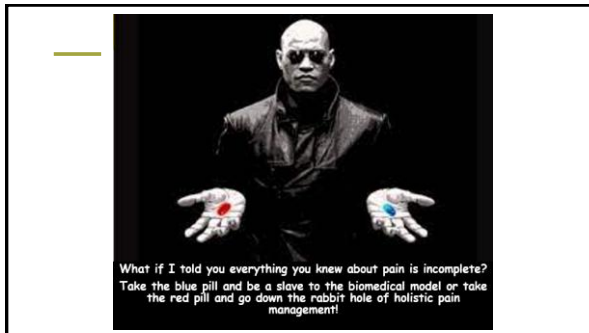
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6

Acknowledgements

- I need to acknowledge the many clinicians and scientists who paved the way for me to work with this clientele group. I am thankful for their pioneering modalities and sharing of information and methods to the training community. These are:

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7



What is Pain and
what are the
Pain
Mechanisms?

8

What is Pain?

- The IASP (International Association for the Study of Pain) defines pain as an "unpleasant sensory and emotional experience associated with, or resembling that associated with, actual or potential tissue damage." (updated in 2021).
- It's normal and necessary... until.
- "Pain is a request for change." (Perry Nicklestone)

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9

Three Categories of Pain Mechanisms (from: Louw et al, 2022)

Nociceptive	Peripheral Neuropathic	Nociplastic (Central Mechanisms)
- Pain localized to the area of injury or dysfunction Clear mechanical or anatomical nature. - Usually intermittent and sharp with movement or mechanical provocation.	- Pain referred in a dermatomal or cutaneous nerve distribution. History of nerve injury pathology, or mechanical compromise. - Pain symptoms are provoked with mechanical testing which move, load, or compress neural tissue.	Disproportionate, non-mechanical, unpredictable pattern of pain provocation in response to multiple or non-specific aggravating/easing factors! - Pain is disproportionate to the nature and extent of injury or pathology. - Diffuse/non-anatomic areas of pain/tenderness on palpation. Strong association with maladaptive psychosocial factors (negative emotions, poor self-efficacy, maladaptive beliefs, and pain behaviours)

All 3 of these mechanisms are involved in all client scenarios. However, usually one mechanism dominates the clinical picture. Think of it like a pie graph.

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10

Managing Pain: Biomedical vs Biopsychosocial Models

"...there is growing evidence that biomedical models used in explaining a pain experience may actually induce more fear and anxiety, which in turn have been linked to the development and maintenance of persistent pain." (PNE 101)

Biomedical Model

Better for Acute Pain.

Biopsychosocial Model

Better for Persistent Pain "Neurotags!"

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11

Biopsychosocial Approach to Persistent Pain (pics from Cor-Kinetic)

Biological

- Age, Gender, Genetics
- Physiologic Reactions
- Tissue Health

Psychological

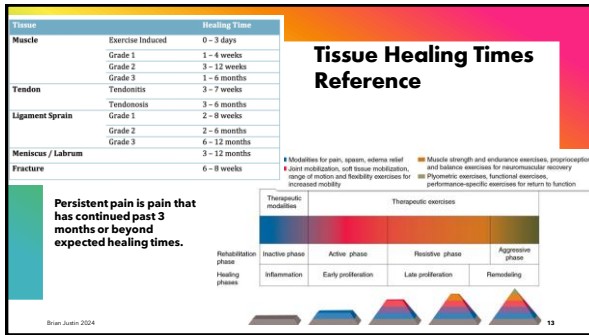
- Mental Health
- Emotional Health
- Beliefs & Expectations

Sociological

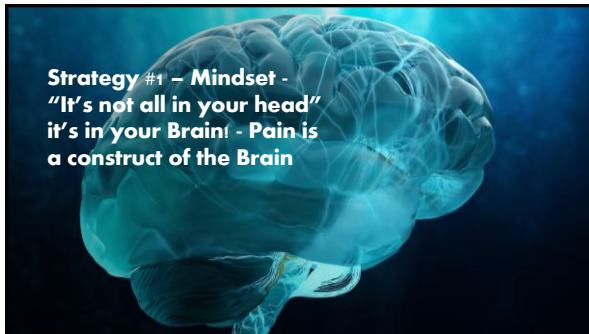
- Interpersonal Relationships
- Social Support Dynamics
- Socioeconomics

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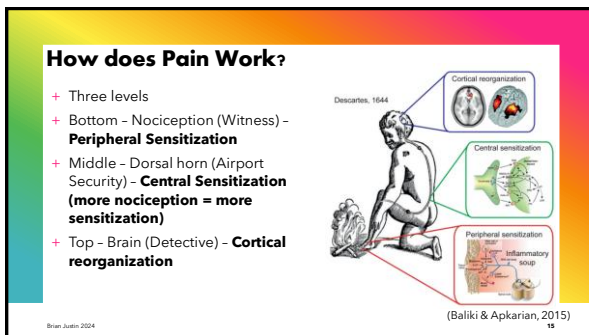
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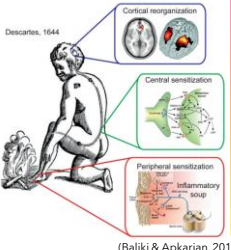
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15

How does Pain Work?

- + Top - Brain
- + Top-down control of dorsal horn.
- + Moseley and Butler call this "Second guessing the periphery".
- + Brain remembers previous patterns of nociception (**neurotags**) and so decides to pay attention or not.
- + **Can turn the pain volume up or down (Drug cabinet opens up).**
- + Triathlon
- + Roll ankle on a busy street (next slide)

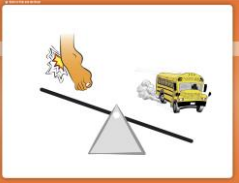


(Baliki & Apkarian, 2015)

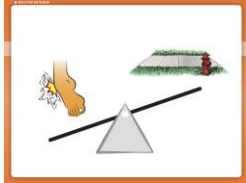
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16

Ankle vs Bus



Ankle vs Sidewalk



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17

The Neurotag! (Neuromatrix) – Biological representation of the BPS

- + **Pain is an interpretation of the best info available to it.**
- + **Neurotag** - The particular pattern of activity that creates the perception of pain. Brain weighs in on all the incoming messages then responds.
- + As per the picture there is not one pain center. There are many that are called "**ignition nodes**".
- + These clusters of nodes are used for sensation, movement, emotions, and memory. **Pain borrows these to express itself** (EP, 2013).
- + In chronic pain these nodes are hijacked by the pain experience like an addiction almost.
- + **Every pain experience is unique.** If the tune from this orchestra of nodes is played too often it leads to persistent pain. **Brain becomes sensitized leading to changes in thinking and to systems such as endocrine/symp and parasymp /immune/and motor systems.** (EP, 2013)



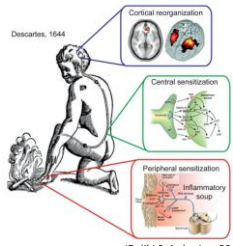
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18

How does Pain Work?

Summary: Brain weighs all the credible evidence of threat (**like a detective**):

- + Nociception (lots = more threat)
- + Past memories (Have I seen this before?)
- + Other sensations (visual ("oh there is a hammer in my neck"), auditory (pop), or proprioceptive (should my shoulder move like this?))
- + Cognition (do we think its normal or horrible?)
- + Emotions
- + Motivation (I need to finish the match)
- + Expectancies (What we expect - placebo)
- + Social Media! ©



(Baliki & Apkarian, 2015)

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19

19

Context! – A Tale of Two Nails (Zoffness, 2020)

- + Construction worker. Pain from nail between toes.



- + Construction worker. 4-inch nail in the face. He thought he escaped it. He didn't address it till his X-ray at the dentist revealed it 6 days later!



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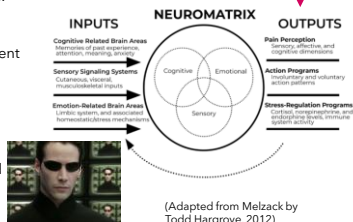
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20

How does Pain Work?

Outputs = Maybe we should do something..

- + Pain Perception
- + Action Programs (protective movement like a limp)
- + Stress Regulation Program (Fight or Flight, immune response etc.)
- + Then the outputs become inputs and loop back on each other!



(Adapted from Melzack by Todd Hargrove, 2012)

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21

21

CENTRAL SENSITIZATION (WALLDEN & NIJS, 2021)

Symptoms associated with central sensitization are:

- Pain migrating from place to place.
- Pain which perpetuates long after initial stimulus or disproportionate to that stimulus.
- Lack of predictability around the pain.
- Pain being unresponsive to non-prescription medication or any local treatment.
- Bottom-up treatments are often ineffective (some exceptions).
- Need for top-down approaches (psychological and emotional)

Managing Pain & Central Sensitivity

```

graph LR
    A[Physiological load] --> B[Central Sensitivity]
    B --> C[Pain & Disease]
    
```

As we will see later – lifestyle matters! This is also where you come in Trainers!!

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22

Hammer in the Neck (6:28)

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23

From a Trainer perspective – Pain is not a good indicator of tissue damage!!

- ✦ Pain is a construct of the brain (not to be confused with, “pain is all in your head” statements).
- ✦ **Context**, nociception, thoughts, prior experiences, memories, emotions, and the meaning you assign to your pain all change your experience of it.
- ✦ **Therefore, pain is not a good indicator of tissue damage. If it is not from an acute traumatic injury.**

24

MRI Studies of Structural damage but no pain (Hargrove, 2022)

- + Necks: 1200 volunteers, 87% bulging discs, incl. 76% of people aged 20-30 (Nakashima 2015)
- + Hips in hockey players: 76% abnormal, 54% show labral tears (Silvis 2011) - osteochondral lesions
- + Shoulders of people aged 20-80: one quarter have rotator cuff tear. (Minagawa 2013); (Tempelhof 1999).
- + Shoulders of overhead athletes: 40% show partial or full thickness rotator cuff tears (Connor 2003).
- + Knees of people aged 20-68: 60% show abnormalities (e.g. torn meniscus) (Beattie, 2005)

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25

Strategy #2 – Think Wholistically and listen to their story!

Rene Descartes – out of here!



26

Rene Descartes and origins of Dualism!

- + Don't get me wrong - Rene Descartes was a brilliant man!
- + Dualism was created out of defense for a time where social order was based on superstition, belief, and magic.
- + Cartesian thinking was an effort to free people from theological dogma and medieval witchcraft through an impersonal objective map of the universe.
- + "I think therefore I am" - He removed the body, emotions, feelings, and sensations in service to what is rational. With the context of above - one can understand his position but unfortunately this dualism philosophy went too far!
- + States of our body help us make decisions. We are BODY-MIND.



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27

27

Listening is key! (1:41)

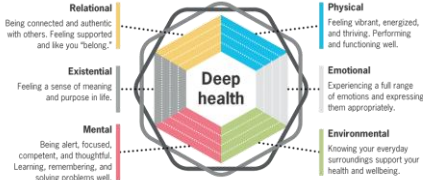


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28

28

Know their whole Story!!

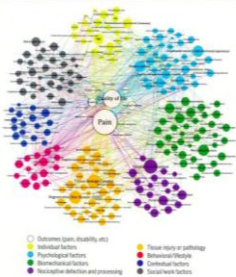


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29

29

Pain Contributors!
(Cholewicki et al.)



We can look at this and get overwhelmed

Or

We can look at this and think there are a lot of options to help someone!!

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30

Knowing their whole story you will know their Pain volume Increases!

Social Factors – Adverse childhood trauma / family relationships / environmental & cultural context / social support – Worst human punishment? = Social isolation.

Psychological Factors – Stinkin’ thinkin’/ poor emotion control /Stress & Anxiety

Biology – Poor ergonomics/ poor exercise choice for individual’s anatomy (biomechanics)/ inactivity / poor nutrition/ **poor sleep**



Pain = Biology + Psychology + Social Factors

Zoffness, R. (2020)

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31

31

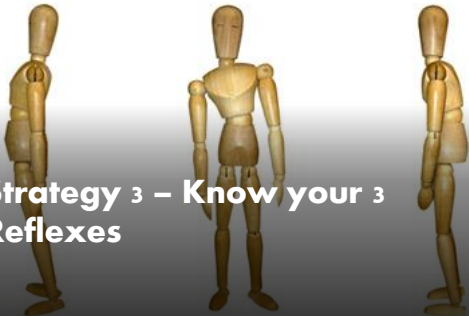
Language - Another Volume Increaser

TABLE	TYPICAL WORDS TO AVOID AND ALTERNATIVES FOR PATIENTS
Words to Avoid	Alternatives
Chronic degenerative changes	Normal age changes
Negative test results	Everything appears normal
Instability	Needs more strength and control
Wear and tear	Normal age changes
Neurological	Nervous system
Don't worry	Everything will be okay
Bone on bone	Narrowing tightness
Isar	Pull
Damage	Repairable harm
Painful	Altered sensations
Trapped nerve	Tight, but can be stretched
Lumbar	The normal curve in your back
Hypertonic	The normal curve in your back
Bulge/Herniation	Bump/swelling
Disease	Condition
Effusion	Swelling
Chronic	It may persist, but you can overcome it
Diagnostics	Xray or scan
You are going to have to live with this	You may need to make some adjustments

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32

32



Strategy 3 – Know your 3 Reflexes

33

11

The 3 Neuromuscular Stress Reflexes (Hanna, 1998)

Stems from Selye's "eustress and "distress"

Red Light Reflex – The withdrawal (fear or freeze) reflex. **Flexion Problem.**

Green Light Reflex – The Landau Reaction (effort). **Extension Problem.**

Trauma Reflex – Usually as a result of injury/surgery. **Side bending Problem**

Reflexes focus around the middle of the body where the COG is

Green Light Reflex vs. Red Light Reflex

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34

Practical #1 – Initial Screen for Persistent Low Back Pain (LBP)

Categories of Discomfort:

- + Extension problem
- + Flexion problem
- + Side bending problem

2 easy tests for evaluating these 3 issues:

1. Supine Test
2. Pelvic Palpatory Test

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35

Strategy 4 - Check for Red and Yellow Flags

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36

- ▶ Recent fall
- ▶ Severe headache
- ▶ Unexplained tachycardia (>100BPM) or bradycardia (< 60 BPM depending on condition – < 40BPM is problematic)
- ▶ Systolic BP > 200mmHg or < 86 mmHg and/or diastolic BP > 110 mmHg
- ▶ **Reddening pain**
- ▶ **Neurologic and breathing**
- ▶ Neurologic symptoms suggestive of a TIA
- ▶ Chest pain and shortness of breath or active wheezing
- ▶ Recent loss of consciousness (Sez)
- ▶ Loss of significant range of motion
- ▶ Loss of function
- ▶ Swelling
- ▶ Open Wounds
- ▶ Lower leg pain at rest
- ▶ Pain in a bone area
- ▶ **High fever** (possibly indicative of a serious organ disorder in the torso)
- ▶ No significant improvement after > 1 month of conservative care

****If any of these signs are present, send your client to their medical professional.****

37

Yellow Flags (Psychosocial factors)

- 80% of people will get low back pain which was the same as 100 years ago!!! **However, disability due to low back pain has increased.**
- 10% of patients with low back pain account for 90% of the cost!
- Yellow flags are **psychosocial factors** that are correlated to the development of persistent pain.
- Need tools like FABQ / PCS/Tampa Scale of Kinesiophobia.



The illustration shows a woman's head with a sad expression. Surrounding her head are seven yellow flags on black poles, each with a label: 'FEAR AND ANXIETY', 'PERSISTENT PAIN', 'SOCIAL SUPPORT', 'DEPRESSION', 'CATASTROPHIZING', 'HYPERSENSITIVITY', and 'PAINFUL MOVEMENTS'.

38

[illegible]

39

Allostatic Load and Central Sensitization (Wallden & Nijs, 2021 and Wallden & Sisson, 2019)

Allostasis – the process by which the body responds to stressors in order to regain homeostasis.

Allostatic load (physiological load) can arise from any situation that takes the body out of optimal homeostasis. **It is the body's response to accumulated stressors.**

Examples:

- Poor blood glucose control
- Unable to relax
- Sleep disturbance
- Poor thinking, anxiety, and belief systems

If these occur over time can cause an allostatic load.

This allostatic load can stress biochemistry, cellular function, visceral function, and systems function.

This can create multiple sub- or supra-threshold drives to the cord resulting in sensitization!! (hence the importance of lifestyle medicine!!)

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40

Your Brain's main job is to manage allostasis!! (Feldman-Barrett, 2020)

- + Brain's main job is **not** thinking!
- + It runs a budget for your body! Scientist call the budgeting process allostasis!
- + Prediction beats reaction. Predict well - you live.

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41

AS MOVEMENT PROFESSIONALS - WE DO THIS!

"Movement patterns represent past experiences, beliefs, and emotional states. They aren't simply a biomechanics representation of ability." - Jennifer Pilotti, 2020

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42

Sensitization to Desensitization

- + Chronic pain changes the Nervous system = Peripheral and Central Sensitization.
- + How do we get things back to "normal"?
- + Desensitization - lowers pain volume.
- + Brain has Neuroplastic Properties
- + **Graded exposure (exercise and movement)**
- + **Modifying behaviours or exercise types (i.e. low back example coming up)**
- + Deep breathing emphasizing exhalation
- + Thought reframing (CBT)
- + **Pharmacological** (opioid crisis? Increased sensitization later!)
- + Massage Therapy (more for peripheral however endorphin release can act on CNS)
- + Healthy diet (anti-inflammatory) - nutrition is your acquired life force
- + **Getting healthier - E=MC² - Energy = More Changeability!**

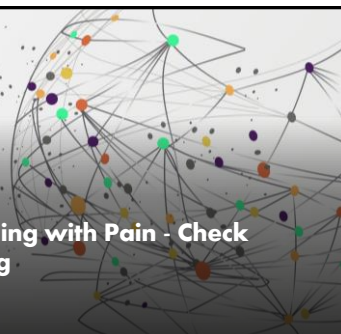
Superhero Fan's Corner
Would prolong exposure to kryptonite desensitize Superman to it?



43

43

Strategy #6 – Training with Pain - Check your Programming



44

Training with Pain (Mash, M. (2020) & Comstock, B. (2005))

1. Check programming - excess volume or intensity
2. Make Modifications (Exercise pattern biomechanics).
3. Make a substitution if necessary.
4. **Re-integrate original lift once things have calmed down or client went to rehab and is now discharged.**



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45

Programming – Is it just too much?

- **Frequency** - times/week
- **Volume** - Sets x reps
- **Intensity** - actual or relative (% 1RM vs RPE)
- **Tonnage** - loads x sets x reps (or load x volume)

Classic mistake by Fit people who have persistent pain - Starting out with too heavy a load. **Clients can get better without getting stronger (Mash, M, 2023).** We can start lower and build them up once they build momentum to get stronger.

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46

RPE Scale for intensity

- **Can start at an RPE of 3-4 to trust their body again initially. Then slowly increase.**
- Most of your client's training should take place in 7-8.5 range. (2-3 Reps in Reserve - RIR)
- Consistently ≥ 9 could invite injury irrespective of technique.
- **Back down Sets Strategy** - Start at normal workload then drop weight by 5%-ish and then complete rest of sets there. Volume is maintained but tonnage lowers the session RPE and hopefully drops pain.
- **If high rep sensitive** - Try more sets less reps - 6 x 5 reps vs 3 x 10 reps. Builds in more "breaks". Same volume but perception will be different.

RPE Scale	
Rating of Perceived Exertion Scale	
10	Could not do more repetitions or weight
9.5	Could not do more repetitions, could do slightly more weight
9	Could do 1 more repetition
8.5	Could do 1 more repetition, possible 2 more repetitions
8	Could do 2 more repetitions
7.5	Could do 2 more, possibly 3 more repetitions
7	Could do 3 more repetitions
5-6	Could do 4 to 6 more repetitions
1-4	Very light effort

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47

Be careful how you turn up the Volume!

- **Spread it out** - Increase frequency but drop session volume.
- **Slowly build chronic workload.**
- Calculate your tonnage per week for 4 weeks - **Chronic workload**
- **Acute workload** - tonnage done in a week.
- Same routine/week - 1.0 acute to chronic ratio (A:C).
- A:C Ratio Injury Risk:
 - < 0.8 = under training
 - 0.8-1.3 = Sweet spot
 - > 1.5 - 2.0 = Injury waiting to happen

Injuries due to volume are usually caused by:

- Acute spikes in volume following lay off.
- Improper progression of work capacity
- Lack of tissue tolerance building

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48

When to Back Off?

- New onset of highly irritable pain. Might have tweaked something.
- Verbiage to listen in for - "Sharp, shooting, burning, buckling, locking, stabbing", pain.
- **Golden Rule: Feels worse 24 hours after exercise means poor toleration of session.**



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49

When to Push Through?

- Low level lingering issues. Poke the bear here to start making gains if client is willing.
- Verbiage - "Mild but tolerable" (monitor the 24-hour response).
- "Sore, achy, tight, weak", ... discomforts we can push through gently.
- **Did they tolerate the session?**
 - **"Mild and tolerable"** is what we are going for (avoid pain scale as it may be skewed)
 - 24-hour rule
 - Expect good and bad days. Good days push them more and bad days pull back



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50

50

What are we trying to do?

- 100% pain-free **vs** tolerability
- Use exercise as a stimulus to promote overall health. **Pain simmers down as a by-product of getting healthier.**
- People can learn to live well with chronic pain. - "Flexible persistence".
- They can be sore but safe.
- **Recovery means being in a state of constant improvement (Moseley, 2024),**



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51

51

Strategy 7 - Biomechanical Modifiers and Movement Continuum.

52

“Calm Shit Down and then Build Shit Back up.” (Lehman, G. – 2020)

SOMETIMES CLIENTS MAY HAVE MECHANICAL CAUSES OF PAIN DUE TO:

1. PERFORMING **POOR FORM** OF AN EXERCISE OVER AND OVER SENSITIZING TISSUES - EASY FIX.
2. PERFORMING EXERCISES THAT DO NOT MATCH THEIR ABILITY OR **ANATOMY** - EASY FIX.
3. FORM AND ANATOMY ARE FINE, SO THEY JUST NEED TO CALM DOWN THE SENSITIZATION. **PICK A MODIFICATION TO ALLOW THIS.**

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53

Modifiable Factors by Movement Pattern

Squat	Hinge	Lunge	Press	Pull
Stance width Toes out Tempo Bar position Depth ROM	Stance width Toes out ROM Tempo	Loading method Step length Shank angle Torso angle Tempo ROM	Grip Width Arm angle Tempo ROM	Grip position Unilateral vs bilateral Loading method ROM Arm angle Tempo

Find the entry point!!

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54

Movement Progression



Vertical Primal Patterns* (w. variations depending on biomechanical challenges)

- Squat / Lunge / Bend
- Push / Pull / Twist
- Gait



Work up to Vertical - Add some challenge but still safe!

- Tall kneeling
- Half Kneeling



Safety First!! - Make your client feel safe!

- Hanna Somatic Movements
- Infant Development Exercises
- Quadruped Movements

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55

Vertical Pushing Patterns

56

Vertical Press Load Continuum (Mash, 2021)

From Less shoulder demand (less ROM) to more shoulder demand (Greater ROM).

Push up to pike push ups

Landmine press

High Incline DB Press

DB Press

Barbell Press





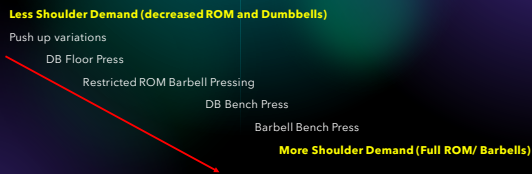
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57

Horizontal Pushing Patterns

58

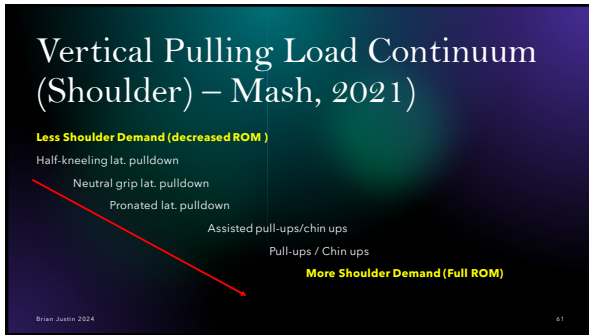
Horizontal Pushing Load Continuum (Shoulder) – Mash, 2021)



59

Vertical Pulling Patterns

60



61



62

Safe!

- Very few people complain of pain in a horizontal row pattern.
- Works the upper back musculature around the scapula.
- Do more pulling over pushing to balance out the shoulder.

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63

Hinging Patterns

64

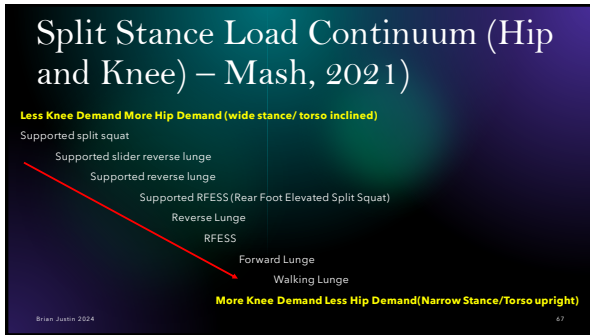
Hinging Load Continuum (Shoulder) – Mash, 2021)



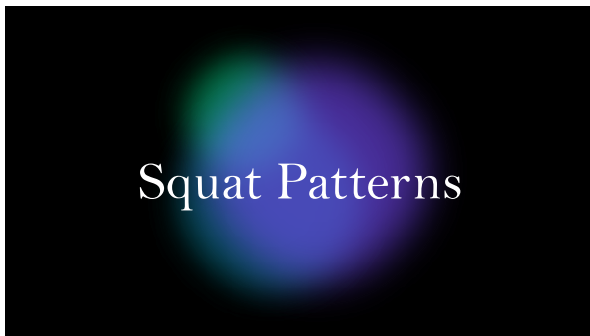
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Split Stance/Lunge Patterns

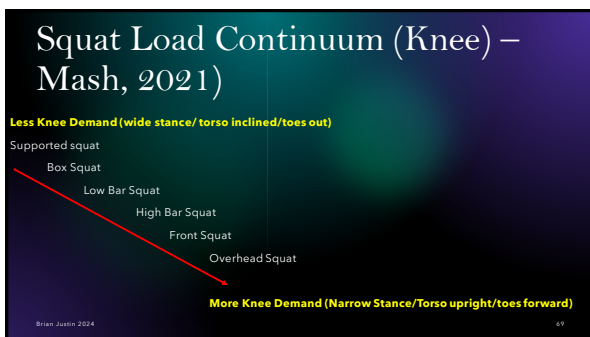
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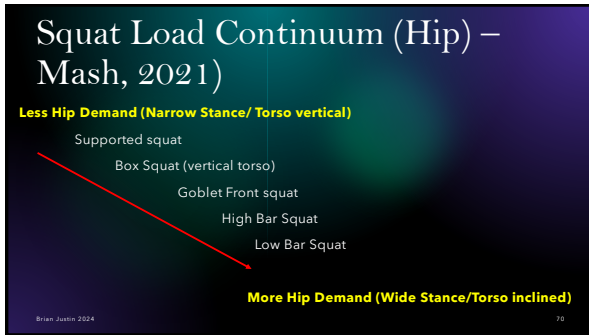
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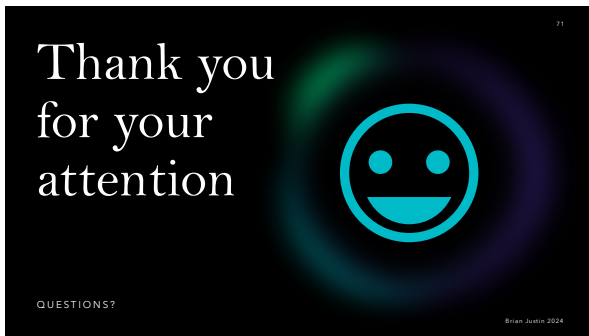
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69



70



71
