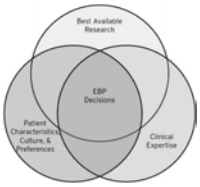


Therapeutic Alliance

Novel Approach to Integrating Focal Vibration into Sports Therapy

Steven Capobianco 1

1

Hello
my name is

Steven Capobianco

DC, MA, DACRB, CSCS
steve@rocktape.com

2

Provider/Financial Disclaimer

RockTape and the presenter for this seminar have financial associations with the manufacturer of commercial products used in this seminar.

You are not required to purchase the supplies or products used in this course.

3

3

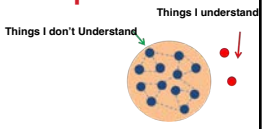
How we think manual therapy (or any kind of treatment) should be

How it actually is

Diane Jacobs

4

"We are fearfully and wonderfully complex



Lorimer Moseley - NOI Group

5

5

"Simple Solutions to Complex Problems is NOT working

NOI - Neuro Orthopedic Institute

6

Chronic Pain Statistics

- Approximately **1.71 billion** people have **musculoskeletal conditions** worldwide.
- **Low back pain** causes the **highest burden** with a prevalence of **568 million people.**
- Musculoskeletal conditions are the **leading contributor to disability worldwide**,
- In 2023, **24.3% of adults had chronic pain**, and 8.5% of adults had high-impact chronic pain

WHO & CDC Data

7

Medically Unexplained Symptoms

MUS diagnoses account for **35-64%** of new patients in general practice

(Jackson and Passomonti, 2005; Steinbrecher et al., 2011)

8

Pain is much more than Nociception.

Jeffrey Mogil, PhD, director of the Alan Edwards Center for Research on Pain, McGill University

9

9

Evolution of Pain Definition

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

- Pain is always a **personal experience** that is **influenced** to varying degrees by **biological**, **psychological**, and **social** factors.
- **Pain & nociception** are **different** phenomena.
- Through their **life experiences**, individuals learn the concept of pain.

Revised International Association for the Study of Pain definition of pain: concepts, challenges, and compromises. PAIN: September 2020 - Volume 161 - Issue 9

10

FMT Stance

Is it not time to reinvent manual therapy and exercise? Could we simply stop trying to study or **'fix'** structural or purely imaginary 'things'?

Could we not just **reframe** them as a way we can interact more with the actual patient/client.

Øberg et al. 2015, Olesen 2015

11

11

Develop a Therapeutic Alliance

Words Matter
Your Attitude Matters
Your Caring Touch Matters
Your Use of Tools Matter

12

Chronic (Persistent) Pain

Where the Body meets the Brain (Mind)

Crofford L. J. (2015). Chronic Pain: Where the Body Meets the Brain. *Transactions of the American Clinical and Climatological Association.*

13

Inadequate Management

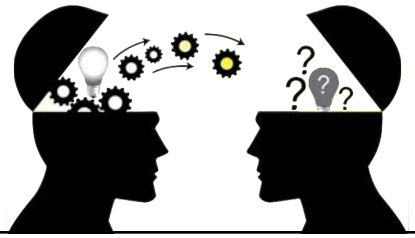
- Unfortunately, **treatments** for chronic pain are woefully **inadequate**
- The symptom that **brings more patients** into our practices than any other but also the symptom most likely to **make us feel helpless** as clinicians
- Developing **new treatment strategies** for patients with chronic pain is of **utmost urgency**

Crofford L. J. (2015). Chronic Pain: Where the Body Meets the Brain. *Transactions of the American Clinical and Climatological Association.*

14

Starting to Communicate

PsychoTherapist Manual Therapist



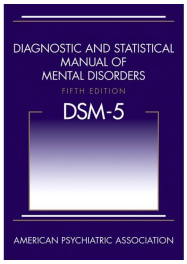
15

15

Somatic Symptoms Disorders

Somatic symptom disorder (SSD) within DSM represents a consolidation of a number of previously listed diagnoses (**MUS** - Multiple Unexplained Symptoms).

Defines the disorder on the basis of **persistent somatic symptoms** associated with disproportionate **feelings, thoughts**, and **behaviors** related to these symptoms.



16

16

Complex Phenomenon

Pain has several important dimensions:

- **Sensory** dimension — where does it hurt and how much does it hurt
- **Emotional** dimension — how unpleasant is the experience
- **Cognitive** dimension — how do we interpret the pain based on our previous experience, does it cause fear and anxiety, and how do we respond to the threat posed by pain

Crofford L. J. (2015). Chronic Pain: Where the Body Meets the Brain. Transactions of the American Clinical and Climatological Association,

17

17

Not Just a Piece of Meat

We are treating **human beings** attached to the meat - along with a **sensory** and **motor** nervous system, previous **experiences**, **history**, **emotions**, etc.....

18

18

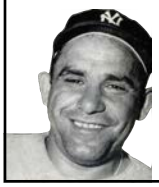
A Person (Brain) Attached to the Tissues

A Complex Approach to Pain and Movement

19

19

Yogi Berra once said, "90% of sports is mental and the other half is in your head."

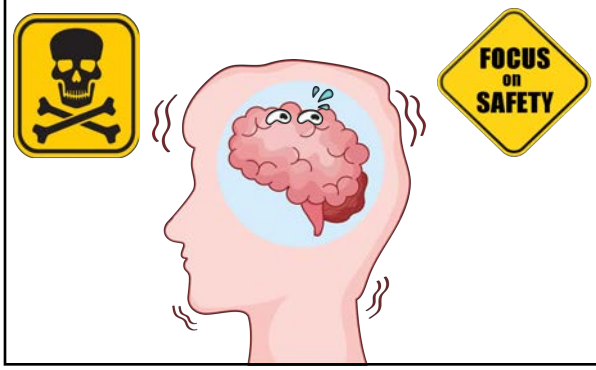


20

Brain's #1 Job

21

Predictive System



22

Busy Brain

The Brain = Continuous Calculations

Predicting the **Future**

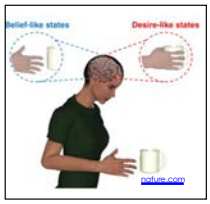
(e.g. *Threats*)

23

23

Predictive Modeling

- The brain is constantly attempting to be one step ahead and matches **expectations** to what is **about** to happen
- It creates an **internal model** of what's going to happen next

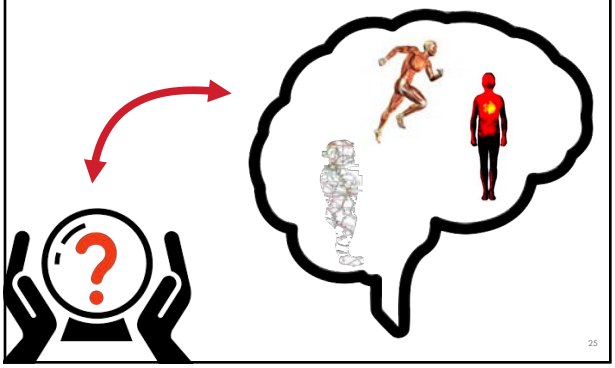


Lars Muckli, professor of neuroscience at the Centre for Cognitive Neuroimaging in Glasgow, Scotland

24

24

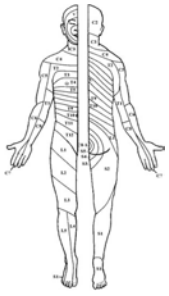
Predicting the Future



25

25

3 Maps



Outer Map
(Extero)

Movement Map
(Proprio)

Inner Map
(Intero)

26

26

3 Maps - Defined

Exteroception is the sensitivity to stimuli that are **outside the body.**
Sight, Smell, Hearing, **Touch**, and Taste

Proprioception the **sense of body movement and position**,
Spatial Orientation in **Motion**

Interoception refers to the process by which the nervous system senses, interprets, and integrates signals **originating from within the body**

Internal Landscape - How do you **Feel**?

27

27

Disembodiment

Poor Resolution of Map Systems

28

28

Hole in our Awareness = Pain

Expectation of the brain that there will be a body:

1. Fragmented body maps (Smudging)
2. Absence of an area/region that your brain is expecting to have
3. That void/absence is filled by pain as a method to increase information to that region (theory)

EG: **Phantom limb pain example** - somethings is not there, brain interprets it as a "threat" and fills the void with **pain**.

29

29

Tactile Acuity - Chronic LBP

Tactile thresholds are preserved yet complex sensory function is impaired over the lumbar spine of chronic non-specific low back pain patients: a preliminary investigation

Benedict M. Wand[a,*], Flavia Di Pietro[b], Pamela George[a], Neil E. O'Connell[c]

[a] School of Health Sciences, The University of Notre Dame Australia, 19 Mouat Street, Fremantle, WA 6959, Australia
[b] St John of God Hospital, Bussell Hwy, Bunbury, WA, Australia
[c] Centre for Research in Rehabilitation, School of Health Sciences and Social Care, Brunel University, Uxbridge, UK

Abstract

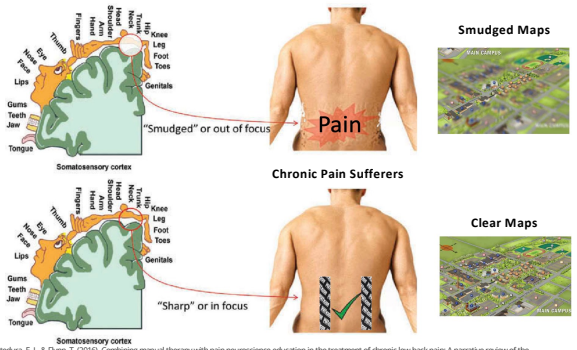
Objectives To investigate impairments in sensory function in chronic non-specific low back pain patients, and the relationship between any impairment and the clinical features of the condition.
Design A cross-sectional case–control study.
Setting Laboratory-based study.
Participants Nineteen chronic non-specific low back pain patients and 19 healthy controls.
Main outcome measures Tactile threshold, two-point discrimination distance and accuracy at a task involving recognising letters drawn over the skin of the lower back (graphaesthesia) were assessed over the lumbar spine in both groups. Pain duration, pain intensity, physical function, anxiety and depression were assessed by questionnaire in the back pain group.
Results No difference was found in tactile threshold between the two groups (median difference 0.0 mg, 95% confidence interval (CI) −0.04 to 0.04). There was a significant difference between controls and back pain patients for two-point discrimination (mean difference 17.9 mm, 95% CI 5.9 to 29.8) and graphaesthesia accuracy (mean difference 6.1, 95% CI 1.3 to 11.0). Low back pain patients had a larger lumbar two-point discrimination distance threshold and a greater letter recognition error rate. In the back pain group, no relationship was found between clinical profile and sensory function, and no relationship was found between the sensory tests.
Conclusions These data support existing findings of perceptual abnormalities in chronic non-specific low back pain patients, and are suggestive of cortical rather than peripheral sensory dysfunction. Amelioration of these abnormalities may present a target for therapeutic intervention.

Keywords: Low back pain; Body image; Neuronal plasticity; Touch perception

30

30

Smudged Maps



Puentedura, E. J., & Flynn, T. (2016). Combining manual therapy with pain neuroscience education in the treatment of chronic low back pain: A narrative review of the literature. *Physiotherapy Theory and Practice, 32*(5), 408-414.

31

Tactile Acuity - OA Knee

Tactile acuity is disrupted in osteoarthritis but is unrelated to disruptions in motor imagery performance

Tasha R. Stanton[1,2], Chung-Wei Christine Lin[3], Helen Bray[1], Rob J. E. M. Smeets[4], Deborah Taylor[5], Roberta Y. W. Law[5] and G. Lorimer Moseley[1,2]

Abstract

Objective. To determine whether tactile acuity is disrupted in people with knee OA and to determine whether tactile acuity, a clinical signature of primary sensory cortex representation, is related to motor imagery performance (MIP; evaluates working body schema) and pain.

Methods. Experiment 1: two-point discrimination (TPD) threshold at the knee was compared between 20 participants with painful knee OA, 20 participants with arm pain and 20 healthy controls. Experiment 2: TPD threshold, MIP (left/right judgements of body parts) and usual pain were assessed in 20 people with painful knee OA, 17 people with back pain and 38 healthy controls (20 knee TPD; 18 back TPD).

Results. People with painful knee OA had larger TPD thresholds than those with arm pain and healthy controls ($P < 0.05$). TPD and MIP were not related in people with knee OA ($P = 0.88$) but were related in people with back pain and in healthy controls ($P < 0.001$). Pain did not relate to TPD threshold or to MIP ($P > 0.15$ for all).

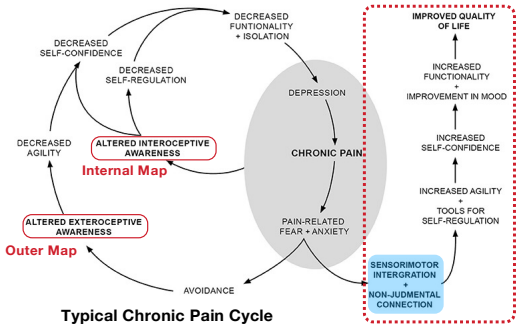
Conclusion. In painful knee OA, tactile acuity at the knee is decreased, implying disrupted representation of the knee in primary sensory cortex. That TPD and MIP were unrelated in knee OA, but related in back pain, suggests that the relationship between them may vary between chronic pain conditions. That pain was not related to TPD threshold nor MIP suggests against the idea that disrupted cortical representations contribute to the pain of either condition.

Key words: osteoarthritis, tactile acuity, two-point discrimination, motor imagery, left/right judgements, sensory-motor incongruence.

32

32

Body Maps and Chronic Pain



Typical Chronic Pain Cycle

Valenzuela-Moguillansky, C., Reyes-Reyes, A., & Gaete, M. I. (2017). Exteroceptive and Interoceptive Body-Self Awareness in Fibromyalgia

33

33

Body Maps & Movement

CLARITY =

Confidence in Movement

34

Confidence

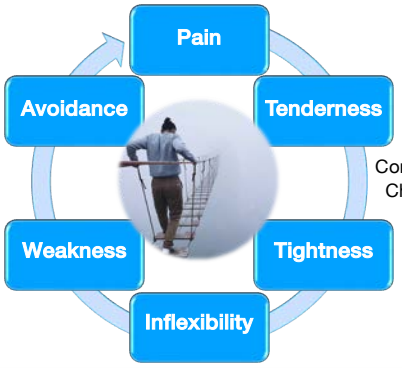
Uncertainty decreases **Confidence**

(Efficiency)

35

35

When you can't Predict



Common Presentations in Chronic/Persistent Pain Sufferers

36

Fascia Can Contract

Fascia Is Able to Actively Contract and May Thereby Influence Musculoskeletal Dynamics: A Histochemical and Mechanographic Investigation

Research suggests that **fascia does have the ability to contract**

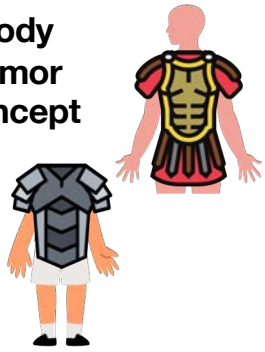
Studies have identified cells within fascia with **characteristics of smooth muscle cells**.

The ability of fascia to contract could explain phenomena like myofascial pain, where **tight or restricted fascia** might **contribute to discomfort**

37

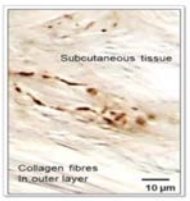
Autonomic Heisman

Body Armor Concept



38

Fascia and ANS



Sympathetic Fibers - **40%** of fascia innervation

What purpose?

- **Micro-circulation -** Temp control

Some argue more:

- **Biomechanical function** (Body Armor)
- **Immune system** (Microbiome in our fascia?)

Mense S. Innervation of the thoracolumbar fascia. Eur J Transl Myol. 2019 Sep 6;29(3):8297.

39

Autonomic Recalibration

Acute pain activates sympathetic arousal, which acts as a **stress-induced analgesic and alleviates pain**.

This pain suppression is mediated by the activation of **descending antinociceptive pathways**

A **prolonged** maladaptive **sympathetic response** leads to inadequate tissue relaxation and blood flow associated with chronic pain

'Tight Traps'

Seton B, Pandey R, Piscura MK, Pearson WG Jr. Autonomic Recalibration: A Promising Approach for Alleviating Myofascial Pain Explored in a Retrospective Case Series. Cureus. 2024 Jan 17;16(1):e52450.

40

Outer Map - Exteroception

How clear is your Outer Map?

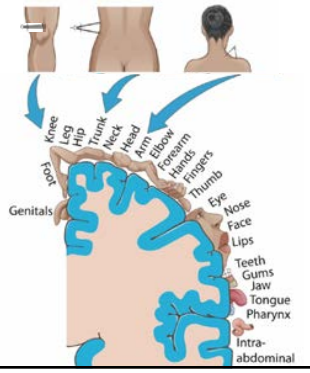
41

2 Pt. Discrimination Tools

Common Clinical Tools

42

Pre-Screen Discrimination



Knee

Low Back

Shoulder

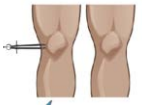
43

43

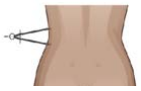
Pre-Screen Discrimination

Normally, a person should be able to recognize two points separated by:

- **2 to 8 mm on fingertips**
- **8 to 12 mm on palms**
- **30-40 mm on shoulder**
- **35–45 mm on the legs**
- **40-55 mm on the back**
- **15-25 mm on the foot**



Knee



Low Back

Shoulder

Bickley, Lynn; Szilagui, Peter (2007). Bates' Guide to Physical Examination and History Taking (9th ed.). Lippincott Williams & Wilkins.

44

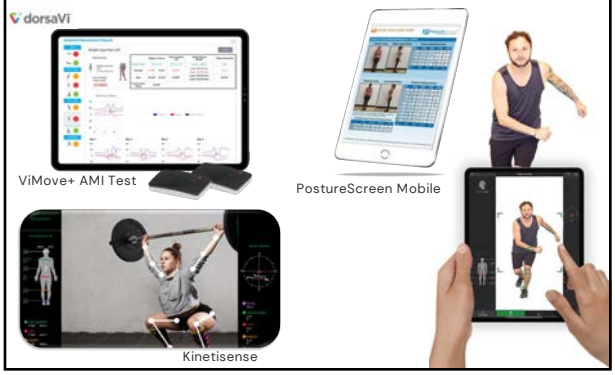
44

Movement Map-Proprioception

How clear is your Movement Map?

45

Movement Map Screens



46

Inner Map - Interoception

How clear is your Inner Map?

47

Measuring Interoception

The detection and awareness of one's bodily state plays a fundamental role in human physiology and human behavior

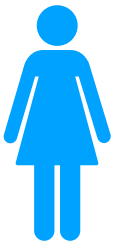
- **Accuracy (Sensitivity)** = Heartbeat Detection Ta used method to measure interoception

- **Awareness** = MAIA: Multidimensional Assessme Interoceptive Awareness

Mehling, W. E., Gopisetty, V., Daubenmier, J., Price, C. J., Hecht, F. M., and Stewart, A. (2009). Body awareness: construct and self-report measures. *PLoS ONE* 4:e5614. doi: 10.1371/journal.pone.0005614

48

Interoceptive Accuracy



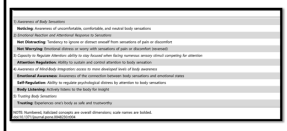
Heartbeat tracking encompasses a suite of quick and easy methods designed to measure cardioception by requiring participants to report the number of heartbeats per min.

Carroll D, Whellock J. 1980. Heart rate perception and voluntary control of heart rate. *Biol. Psychol.* 11, 169–180

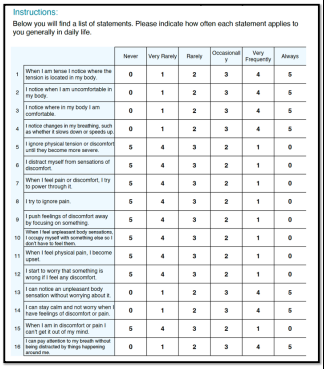
49

Interoceptive Awareness

The Multidimensional Assessment of Interoceptive Awareness (**MAIA**)



https://osher.ucsf.edu/research/maia



Instructions:

Below you will find a list of statements. Please indicate how often each statement applies to you generally in daily life.

		Never	Very Rarely	Rarely	Occasionally	Very Frequently	Always
1	When I am tense I notice where the tension is located in my body.	0	1	2	3	4	5
2	I notice when I am uncomfortable in my body.	0	1	2	3	4	5
3	I notice where in my body I am comfortable.	0	1	2	3	4	5
4	I notice changes in my breathing, such as whether it slows down or speeds up.	0	1	2	3	4	5
5	I ignore physical tension or discomfort until they become more severe.	5	4	3	2	1	0
6	I distract myself from sensations of discomfort.	5	4	3	2	1	0
7	When I feel pain or discomfort, I try to power through it.	5	4	3	2	1	0
8	I try to ignore pain.	5	4	3	2	1	0
9	I push feelings of discomfort away by focusing on something.	5	4	3	2	1	0
10	When I feel unpleasant body sensations, I occupy myself with something else so I don't have to feel them.	5	4	3	2	1	0
11	When I feel physical pain, I become upset.	5	4	3	2	1	0
12	I start to worry that something is wrong if I feel any discomfort.	5	4	3	2	1	0
13	I can notice an unpleasant body sensation without worrying about it.	0	1	2	3	4	5
14	I can stay calm and not worry when I have feelings of discomfort or pain.	0	1	2	3	4	5
15	When I am in discomfort or pain I can't get it out of my mind.	5	4	3	2	1	0
16	I can pay attention to my breath without being distracted by things happening around me.	0	1	2	3	4	5

50

Observation/Palpation

Heisman Signs

Poor Body Maps

Uncertainty

Decreased Confidence

Threat

Pain

Compromised Movement

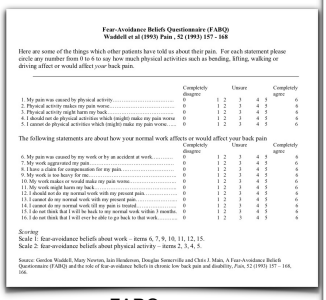
51

Autonomic Heismans




52

Objective Threat Screens



Fear-Avoidance Beliefs Questionnaire (FABQ)
Waddell et al (1993) Pain , 52 (1993) 157 - 168

Here are some of the things which other patients have told us about their pain. For each statement please circle any number from 0 to 6 to say how much physical activities such as bending, lifting, walking or driving affect or would affect your back pain.

	Completely disagree			Unsure			Completely agree
1. My pain was caused by physical activity	0	1	2	3	4	5	6
2. Physical activity makes my pain worse	0	1	2	3	4	5	6
3. Physical activity might harm my back	0	1	2	3	4	5	6
4. I should not do physical activities which (might) make my pain worse	0	1	2	3	4	5	6
5. I cannot do physical activities which (might) make my pain worse	0	1	2	3	4	5	6

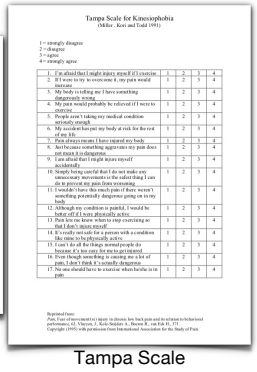
The following statements are about how your normal work affects or would affect your back pain

	Completely disagree			Unsure			Completely agree
6. My pain was caused by my work or by an accident at work	0	1	2	3	4	5	6
7. My work aggravated my pain	0	1	2	3	4	5	6
8. I have a claim for compensation for my pain	0	1	2	3	4	5	6
9. My work is too heavy for me	0	1	2	3	4	5	6
10. My work makes or would make my pain worse	0	1	2	3	4	5	6
11. My work might harm my back	0	1	2	3	4	5	6
12. I should not do my normal work with my present pain	0	1	2	3	4	5	6
13. I cannot do my normal work with my present pain	0	1	2	3	4	5	6
14. I cannot decide anything about my work because of my pain	0	1	2	3	4	5	6
15. I do not think that I will be back to my normal work within 3 months	0	1	2	3	4	5	6
16. I do not think that I will ever be able to go back to that work	0	1	2	3	4	5	6

Scoring
Scale 1: fear-avoidance beliefs about work – items 6, 7, 9, 10, 11, 12, 15.
Scale 2: fear-avoidance beliefs about physical activity – items 2, 3, 4, 5.

Source: Gordon Waddell, Mary Newton, Iain Henderson, Douglas Somerville and Chris J. Main, A Fear-Avoidance Beliefs Questionnaire (FABQ) and the role of fear-avoidance beliefs in chronic low back pain and disability, *Pain*, 52 (1993) 157 – 168. 166.

FABQ



Tampa Scale for Kinesiophobia
(Miller , Kori and Todd 1991)

1 = strongly disagree
2 = disagree
3 = agree
4 = strongly agree

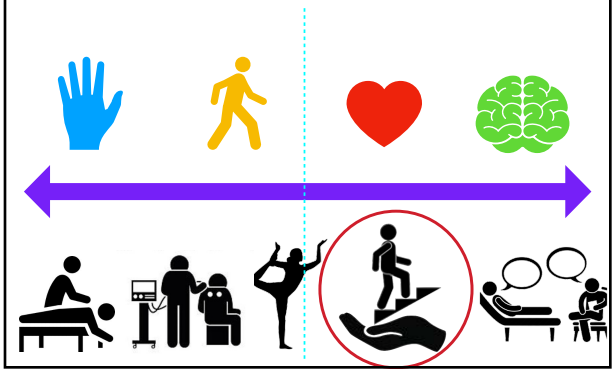
1. I'm afraid that I might injure myself if I exercise	1	2	3	4
2. If I were to try to overcome it, my pain would increase	1	2	3	4
3. My body is telling me I have something dangerously wrong	1	2	3	4
4. My pain would probably be relieved if I were to exercise	1	2	3	4
5. People aren't taking my medical condition seriously enough	1	2	3	4
6. My accident has put my body at risk for the rest of my life	1	2	3	4
7. Pain always means I have injured my body	1	2	3	4
8. Just because something aggravates my pain does not mean it is dangerous	1	2	3	4
9. I am afraid that I might injure myself accidentally	1	2	3	4
10. Simply being careful that I do not make any unnecessary movements is the safest thing I can do to prevent my pain from being worsened	1	2	3	4
11. I wouldn't have this much pain if there weren't something potentially dangerous going on in my body	1	2	3	4
12. Although my condition is painful, I would be better off if I were physically active	1	2	3	4
13. Pain lets me know when to stop exercising so that I don't injure myself	1	2	3	4
14. People would be surprised if a person with a condition like mine to be physically active	1	2	3	4
15. I can't do all the things normal people do because it's too easy for me to get injured	1	2	3	4
16. Even though something is causing me a lot of pain, I don't think it's actually dangerous	1	2	3	4
17. No one should have to exercise when he/she is in pain	1	2	3	4

Reprinted from:
Pain, Fear of movement/(re) injury in chronic low back pain and its relation to behavioral performance, 42, Vlaeyen, J., Kole-Snijders A., Boeren R., van Eek H., 771 –
Copyright (1995) with permission from International Association for the Study of Pain.

Tampa Scale

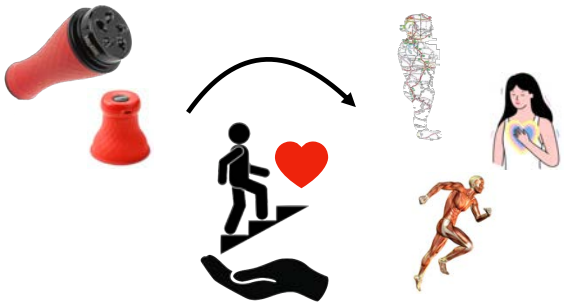
53

Therapeutic Spectrum



54

Holistic Framework



Clarify **3 Maps**

Improve **Predictive Coding**

Foster **Hope**

55

Reconnect

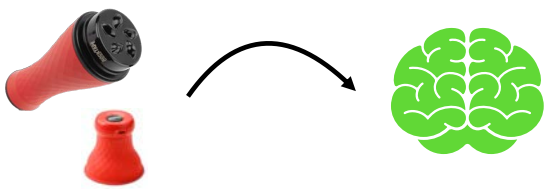
Outer Map

Inner Map

Movement Map

56

Novel Stimulus

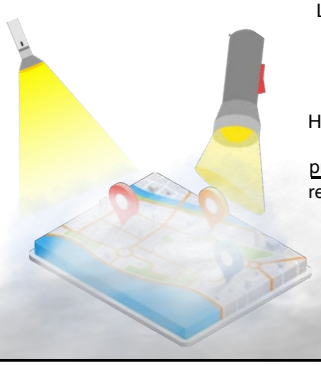


"**stimuli** that are **novel** and deviate from an expectation or prediction have the potential to **bias attention**"

Horstmann, G., Herwig, A. Novelty biases attention and gaze in a surprise trial. *Atten Percept Psychophys* **78,** 69–77 (2016)

57

Blind Spot Concept



Let nervous systems figure out how to do all their own heavy lifting, self-correction, positive feedback loop dismantling.

Hold up a **kinesthetic flashlight** so that a brain can see a pain problem well enough to realize it represents a waste of its energy.

Diane Jacob – DNM
Jill Miller – TuneUp Fitness

58

Kinesthetic Flashlight

"Give the brain a chance to see a pain problem well enough to realize it represents a waste of its energy and talents, and devise a solution that best suits it."

Dermoneuromodulation

59

Vibration = Novel Stimulus

Vibration Intent Reconnect

60

2

Vibration Methods

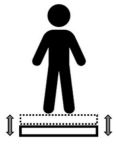
61

61

Types

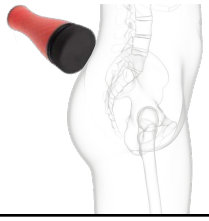
Whole Body
(Indirect)

Sends vibrations into the whole body by having the user sit, stand, or lay on a large platform that vibrates.



Focal/Targeted/Local
(Direct)

Focuses on a particular part of the body using a handheld or worn device



62

62

Comparison

Whole body Vibration (WBV):

- **Not directed to a specific muscle group**
- The stimuli is **widespread**
- Some **side effects -** e.g. dizziness

Focal Vibration (FV):

- Used to **target specific muscle groups**
- Can be applied in a **seated** position with **minimum side effects**
- Stimulus is **directly applied to the region of interest** and can be of a **lower frequency**

63

63

3

Clinical Research

64

64

Focal Vibration on DPN

Wearable Focal Muscle Vibration on Pain, Balance, Mobility, and Sensation in Individuals with Diabetic Peripheral Neuropathy: A Pilot Study

- **Focal vibration** therapy was associated with **improved pain**, **mobility**, and **sensation**

Chandrashekhar R, Wang H, Dionne C, James S, Burzycki J. Wearable Focal Muscle Vibration on Pain, Balance, Mobilit

65

Focal Vibration + Post Stroke

Short-term effect of local muscle vibration treatment versus sham therapy on upper limb in chronic post-stroke patients: a randomized controlled trial

- Rehabilitation treatment with local muscle high frequency vibration for 30 minutes, 3 times a week for 4 weeks, could significantly **improve muscle strength** and **decrease muscle tonus**, **disability and pain** in upper limb of hemiplegic post-**stroke patients**.

Costantino C, Galuppo L, Romiti D. Short-term effect of local muscle vibration treatment versus sham therapy on upper

66

Vibration + Shoulder Mobility

- The study indicates that this treatment could possibly **improve ROM** and well-being for patients with **frozen shoulder.**

Borg H, Bohlin H, Ranje-Nordin C (2019) Can Myofascial Treatment with Pulsating Vibrations Improve Mobility for Patients with Frozer

67

Focal Vibration + Knee OA

- In this study, **FMV** therapy proved to be **effective and safe** in **improving functioning** of patients affected by mild to moderate **chronic knee OA**.
- The use of FMV therapy might be an additional and **safe tool in the conservative management** of knee OA.

Rabini A, de Sire A, Marzetti E, Gimigliano R, Ferriero G, Piazzini DB, Iolascon G, Gimigliano F. Effects of focal muscle vibration on physical functioning in patients with knee ost

68

Vibration & LBP Fatigue/Control

- Local muscle vibration led to significant **trunk neuromuscular control improvements** in the **cLBP** patients before and after a muscle fatigue protocol
- Muscle **vibration stimulation during motor control exercises** is likely to influence motor adaptation and could be considered in the treatment of cLBP

Boucher, J. A., Abboud, J., Nougarou, F., Normand, M. C., & Descarreaux, M. (2015). The Effects of Vibration and Musc

69

Fatigue Attenuation

- Local Vibration = **2 mins @ 30HZ**
- **Attenuated** the symptoms associated with **fatigue**

Otadi K, Ghasemi M, Jalaie S, Bagheri H, Azizian M, Emamdoost S, Sarafraz H, Sepahvand M. A prophylactic effect of l

70

Focal Vibration Tools

71

71

Disinfecting

Silicone Pod

Plastic Heads

72

72

Vibration Tool

4 Levels of Vibration

20-60Hz

Angle of Approach

Overpressure

External vs Internal Glide

73

73

2 Style of Treatment Head

74

Boney Prominences

75

75

Clothing/Skin

Caution: some clothing material can become warm/hot under friction.

Maintain good communication throughout the treatment

76

Targeted

77

Depth Meter

Superficial

Augmented Decompression

Medium

Deep

78

Depth Meter

Hovering

79

79

Depth Meter

80

80

Vibrating Cup

3 Levels of Vibration

75-125Hz

External vs. Internal Glide

Combination

81

81

Pod Assembly

82

Plunge Method

83

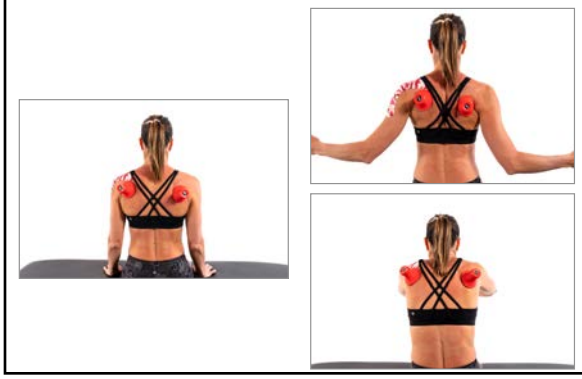
Inversion Method

84

Augmented External Glide

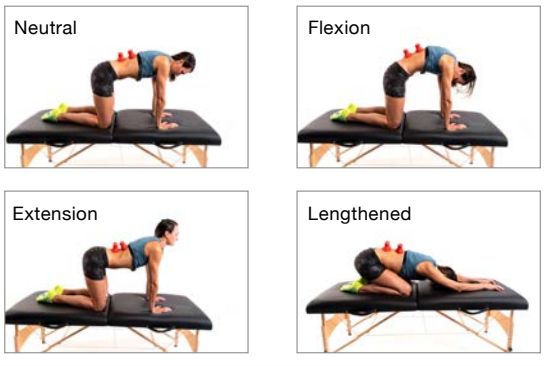
85

Internal Glide



86

Low Back - Length Variations



87

Length Meter



Short | Neutral | Lengthened



88

88

Tone Meter



Relaxed | Contracted | Resisted



89

89

Ripple Meter



Distal | Mid | Proximal



90

90

Breakout

Frequencies

External/Internal Glides

Zones

Position

Tone

Ripple

91

4

Proposed Mechanism

Mechanical
Fluid
Neurosensory
Chemical

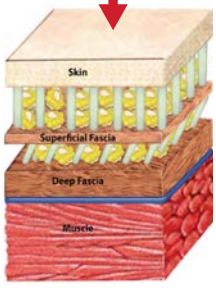
92

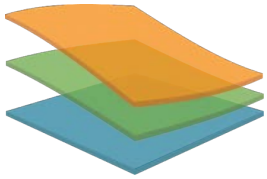
92

Mechanical Forces + Tissue Glide

Compression
Decompression

Shear





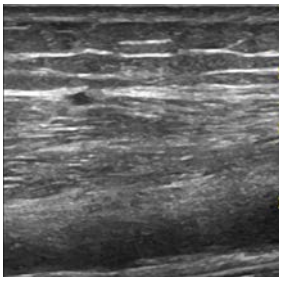
Vibration

https://www.fascialmanipulation.com/en/

93

93

MSK Ultrasound Tutorial



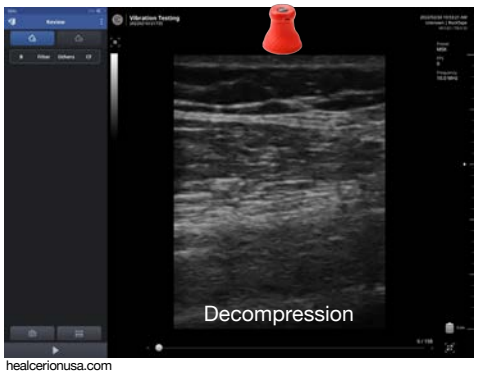
HEALCERION

94

Pod App - Off Loading

95

Under the Skin - Measurements



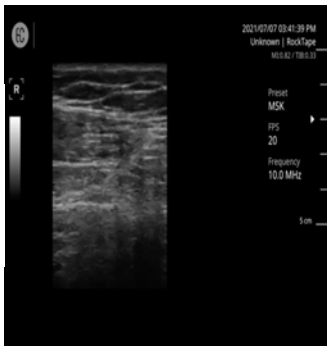
healcerionusa.com

96

96

Frequency Based Effects

20-30 HZ

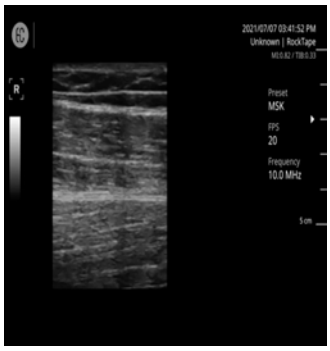


MSK Ultrasound 97

97

Frequency Based Effects

30-40 HZ

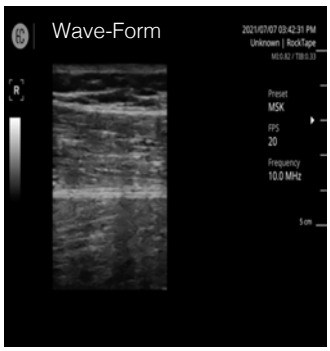


MSK Ultrasound 98

98

Frequency Based Effects

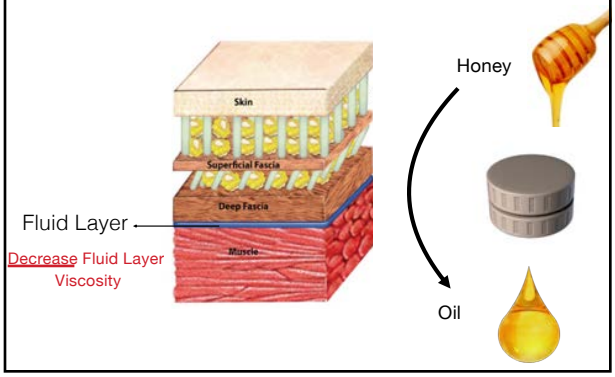
50-60 HZ



MSK Ultrasound 99

99

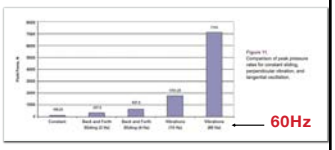
Fluid Viscosity (Tissue Mobility)



100

Fluid Dynamics

- Hyaluronan or hyaluronic acid (HA) is found throughout the extracellular space of higher animals, in human skeletal muscle of the lower extremities, and in loose connective tissue.
- HA produces a **gliding interface** in conjunction with the epimysium of the muscle.
- **Tangential shearing** and **perpendicular vibration** demonstrated the most effective influence to the concentration of **Hyaluronan**



Roman M, Chaudhry H, Bukiet B, Stecco A, Findley TW. Mathematical analysis of the flow of hyaluronic acid around fas

101

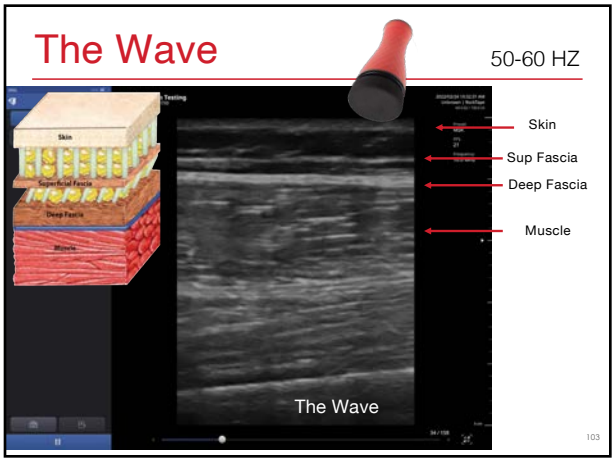
Calf - Linear External Glides

Shearing Movement

102

The Wave

50-60 HZ



103

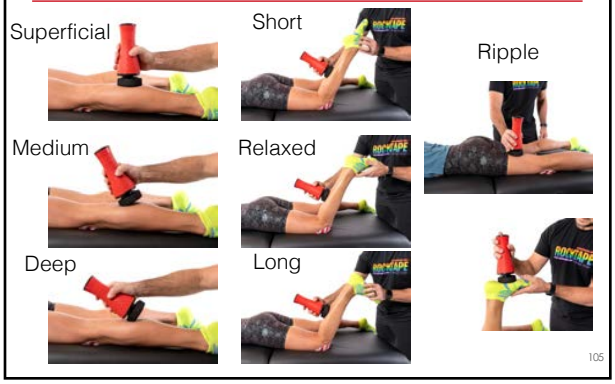
103

Squeeze Film Theory

104

104

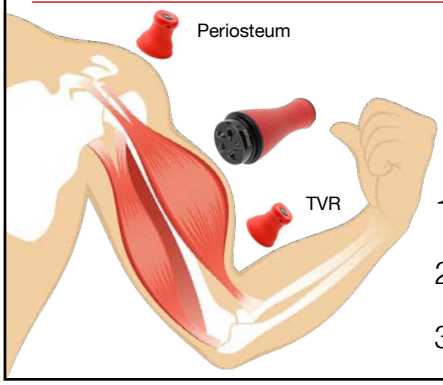
Exposure Therapy (Contraints)



105

105

3 Zones



1. Tendon
2. Belly
3. Bone

106

106

Hemodynamics (Blood Flow)

- Feet on a platform, producing oscillating mechanical vibrations of **26 Hz**
- **Power Doppler sonography** and arterial blood flow of the popliteal artery with a Doppler ultrasound machine
- The mean **blood flow velocity** in the popliteal artery **increased** from 6.5 to 13.0 cm s±1 and its resistive index was significantly reduced.

Kerschan-Schindl K, Grampp S, Henk C, Resch H, Preisinger E, Fialka-Moser V, Imhof H. Whole-body vibration exercise leads to alterations in

107

107

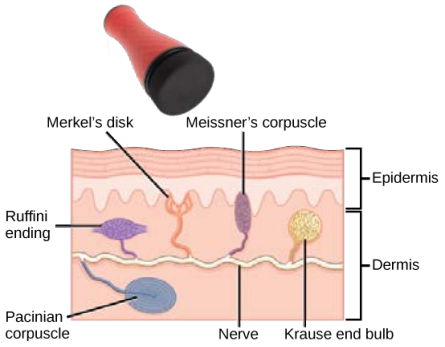
> Everyone is treating neurology, mostly by mistake.

Dr Eric Cobb (Z-Health Founder)

108

108

Sensory Effects



109

109

Vibro-Tactile Science

Vibrotactile information is mainly encoded by two predominant vibration-sensitive receptors

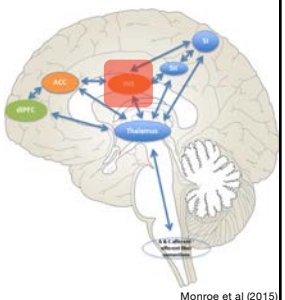
- **Meissner** - most sensitive in the **flutter range** - **5 to 50Hz**
- **Pacinian** Corpuscles - most sensitive in the **vibration range** - **65-400Hz**

Luna, R., Hernández, A., Brody, C. D. & Romo, R. Neural codes for perceptual discrimination in primary somatosensory cortex. Nat Neurosci.8,

110

Descending Pain Control Network

- The **descending pain control network** comprises regions such as the Dorsolateral Prefrontal Cortex (DLPFC), rostral Anterior Cingulate Cortex, the **Insula**, and Periaqueductal gray (PAG).
- **Activation** and functional connectivity between these regions are positively **correlated** with the level of **pain relief** reported.
- Furthermore, the **top-down influence** has been shown to **alter responses** in the spinal dorsal horn, which suggests that it can **modulate nociceptive processing** at an early stage



Monroe et al (2015)

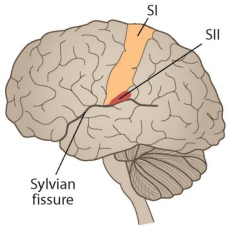
H. Cho et al., Nat. Neurosci. 15, 1015–1021 (2012)

111

111

Touch Discrimination Cortices

- The **primary somatosensory** area **(S1)** has a high degree of localization
- The **secondary area (S2)** has very poor localization
  - involved in tactile object **recognition** and **memory**
  - S2 is also thought to represent the **sensory discriminative aspects of pain**



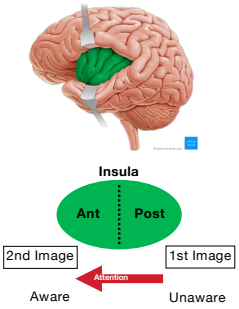
Christova, M., Golaszewski, S., Ischebeck, A., Kunz, A., Rafolt, D., Nardone, R., & Gallasch, E. (2013). Mechanical flutter stimulation induces a lasting response in the sensorimotor cortex as revealed with BOLD fMRI. *Human brain mapping*, 34(11), 2767–2774. https://doi.org/10.1002/hbm.22102

112

112

Touch Salience Cortex

- Therapeutic Touch is **NEVER** neutral
- It's always **colored as it is filtered** through the **Insula** to give it **meaning**.
- Initial Picture (**Subconscious**) - Representation of the **Posterior Insula**
- **Anterior Insula** (**Conscious**) - Interoceptive Re-Representation
- Transient **flow from unaware to Body Aware**!



113

113

Somatosensory System

- Primary somatosensory cortex (**SI**) is presumed to process and encode **type and intensity** of the sensory inputs (Discriminative)

Flutter Range (Lower Frequencies)

- Secondary somatosensory cortex (**SII**) is believed to perform **higher order functions** including sensorimotor integration **= pain, attention, learning and memory**.

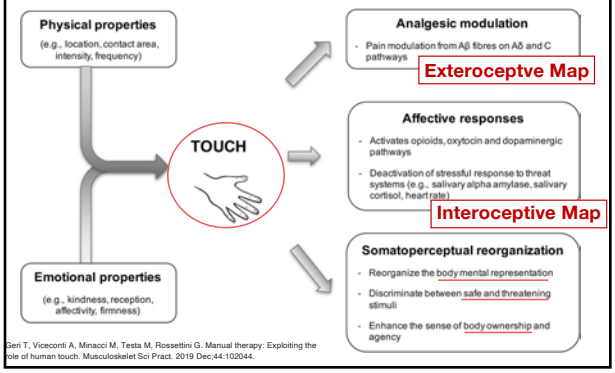
Higher Frequency Range

Chen TL, Babiloni C, Ferretti A, Perrucci MG, Romani GL, Rossini PM, Tartaro A, Del Gratta C. Human secondary somatosensory cortex is involved in the processing of somat

114

114

Somatoperceptual Reorganization

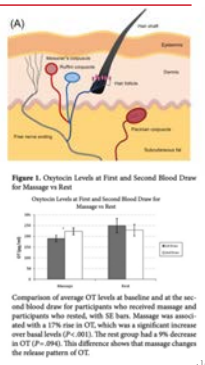


Geri T, Viceconti A, Minacci M, Testa M, Rossettini G. Manual therapy: Exploiting the role of human touch. Musculoskelet Sci Pract. 2019 Dec;44:102044.

115

Hormone Response - Oxytocin

- Physical stimulation of the somatosensory organs induces an **increase in oxytocin levels**
- Oxytocin levels are increased in the human body by physical stimulation (e.g., **vibration** and massage of hair and hairless [glabrous] skin) via somatosensory organs
- Oxytocin can **induce pain relief** and described the possibility how oxytocin in the dorsal horn and/or the **dorsal root ganglion** relieves joint and muscle pain.



Morhenn V, Beavin LE, Zak PJ. Massage increases oxytocin and reduces adrenocorticotropin hormone in humans. Altern Ther Health Med. 2012 Nov-Dec;18(6):11-8.

116

Local Vibration + Healing (2018)

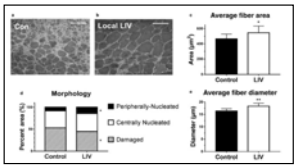
- Low-intensity vibration (LIV) at **45 Hz** and 0.4 g **enhances myofiber growth** following laceration muscle injury in mice at 14 days post-injury
- The LIV-induced **improvements in muscle healing** suggest that it may represent a novel therapeutic approach for improving the healing of traumatic muscle injuries

Corbiere, T. F., Weinheimer-Haus, E. M., Judex, S., & Koh, T. J. (2018). Low-Intensity Vibration Improves Muscle Healing

117

Local Vibration + Healing (2020)

Local low-intensity vibration improves healing of muscle injury in mice



- These findings demonstrate that **muscle cells** can directly transduce LIV signals into **increased growth** and differentiation, and this effect is associated with **increased Akt signaling**

Corbiere, T. F., & Koh, T. J. (2020). Local low-intensity vibration improves healing of muscle injury in mice. Physiological

118

5

Contraindications

119

119

Contraindications

- Kidney or Bladder Stones
- Arrhythmia
- Pregnancy
- Epilepsy
- Seizures
- Cancer
- Pacemaker
- Untreated Orthostatic Hypotension
- Recent Implants (Joint, Corneal, Cochlear, etc)
- Recent Surgery
- Recent placed intrauterine devices or pins
- Acute thrombosis or hernia
- Acute rheumatoid arthritis
- Serious cardiovascular disease
- Severe diabetes
- Migraines

MOST ARE ONLY OVER LOCAL AREA

Saggini, Raoul. The Mechanical Vibration: Therapeutic Effects and Applications (p. 42). Bentham Science Publishers. Ki

120

6

Reframed Approach
Clinical Application

121

121

The FMT Layered Approach

Connect

Curiosity

Breath

Explore (Play)

122

122

The FMT Layered Approach

Connect

Curiosity

Breath

Explore (Play)

123

123

Outer Map

Connect

- **Painting** the Area
- Body **Re-Mapping**
- **Extinguish**/Defuse the Threat

124

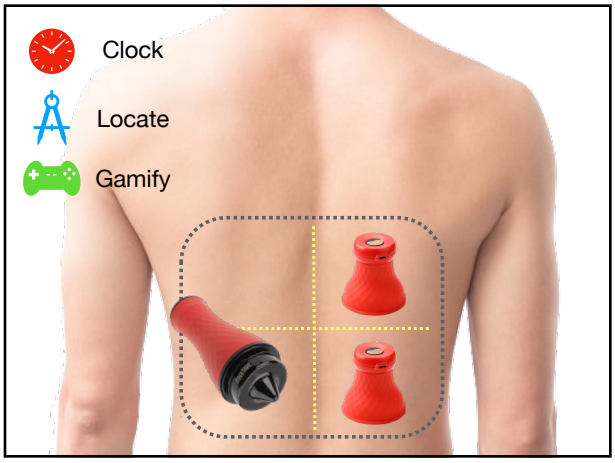
124

Extinguish the Threat

Novel and Non-Noxious
Vibration Frequencies
Threat Inoculation (Pain Mitigation)
Diminish the Significance of the Old Sensation

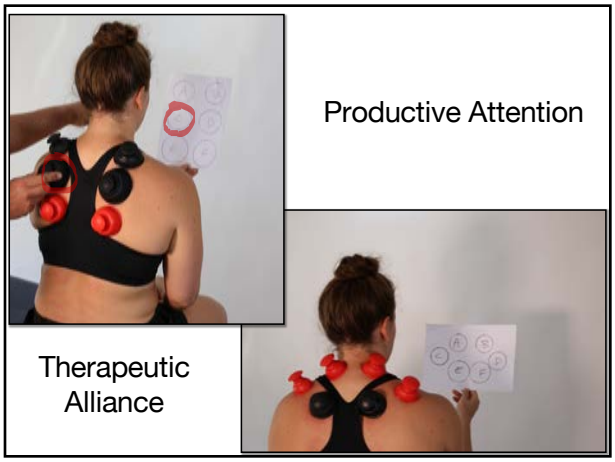
125

125



126

126



127

Shoulder

Dosage - Outer Map
Flutter Range = 5-50Hz
Improved Discrimination

128

Breakout

Low Back/Shoulder

Localization

External Glide

Direction

129

Inner Map

Curiosity

- **Judgement-Free** Assessment

- Productive **Attention**

- **Reappraisal** (Rewire)

130

130

> Interoceptive conditioning has been hypothesized to be of importance in the etiology, maintenance and treatment of chronic pain

DePeuter et al

De Peuter,S.,VanDiest,I.,Vansteenwegen,D.,VandenBergh,O.,and Vlaeyen, J. W.(2011).Understanding fear of pain in chronicspai

131

131

> There is no negotiating what **pain/threat** feels like
>
> There is only **negotiating** what it all m**eans**

Andrew Huberman PhD

132

132

Productive Attention

"In the future one would hope that by **selective stimulation** of areas responsible for attention to pain, we could encourage **productive forms of attention** (for example, attention to location), and **discourage counterproductive ones** (attention to intensity), to find another weapon in the battle with chronic pain".
Oleg Lobanov - International Association for the Study of Pain (IASP).

Selective Stimulation (Non-Noxious)

Productive/Curiosity Attention

Curiosity

ReMapping

Lobanov OV, Quevedo AS, Hadsel MS, Kraft RA, & Coghill RC (2013). Frontoparietal mechanisms supporting attention to location and intensity of painful stimuli. *Pain, 154* (9).

133

Somatic Reappraisal Approach

Facilitating Adaptive Emotion Processing and Somatic Reappraisal via Sustained Mindful Interoceptive Attention

Cynthia Price PhD

'**Emotions** are by nature **Embodied**'

Framework where the bridge between implicit **bodily sensations** and **explicit narratives** lies in cultivating **mindful awareness of bodily sensations associated with emotions**

Price CJ, Weng HY. Facilitating Adaptive Emotion Processing and Somatic Reappraisal via Sustained Mindful Interoceptive Attention. Front Ps

134

Pain Reprocessing Therapy

Effect of Pain Reprocessing Therapy vs Placebo and Usual Care for Patients With Chronic Back Pain
A Randomized Clinical Trial

A brain that **learns** to produce **pain** can **unlearn** it too.

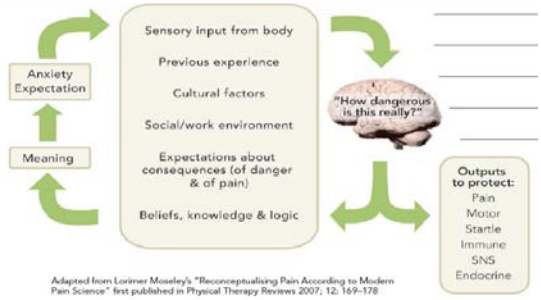
Address our **thinking**, **feeling**, & **behavioral** patterns

We can **train our brains**, we can change our experience of pain

Ashar YK, Gordon A, Schubiner H, Uipi C, Knight K, Anderson Z, Carlisle J, Polisky L, Geuter S, Flood TF, Kragel PA, Dimidjian S, Lumley MA,

135

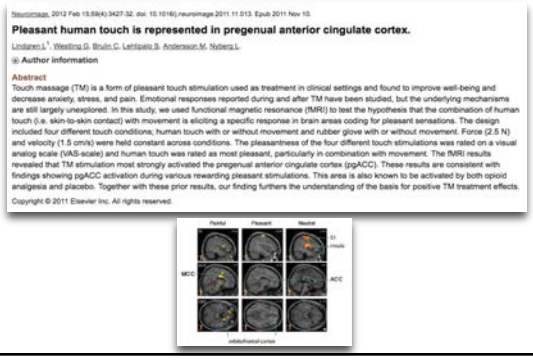
Reconceptualizing Pain



Adapted from Lorimer Moseley's "Reconceptualising Pain According to Modern Pain Science" first published in Physical Therapy Reviews 2007; 12: 169–178

136

Affective Touch and Pain Modulation



Pleasant human touch is represented in pregenual anterior cingulate cortex.

Lindgren L[1], Westling G, Brulin C, Lehtipalo S, Andersson M, Nyberg L

Author information

Abstract

Touch massage (TM) is a form of pleasant touch stimulation used as treatment in clinical settings and found to improve well-being and decrease anxiety, stress, and pain. Emotional responses reported during and after TM have been studied, but the underlying mechanisms are still largely unexplored. In this study, we used functional magnetic resonance (fMRI) to test the hypothesis that the combination of human touch (i.e. skin-to-skin contact) with movement is eliciting a specific response in brain areas coding for pleasant sensations. The design included four different touch conditions; human touch with or without movement and rubber glove with or without movement. Force (2.5 N) and velocity (1.5 cm/s) were held constant across conditions. The pleasantness of the four different touch stimulations was rated on a visual analog scale (VAS-scale) and human touch was rated as most pleasant, particularly in combination with movement. The fMRI results revealed that TM stimulation most strongly activated the pregenual anterior cingulate cortex (pgACC). These results are consistent with findings showing pgACC activation during various rewarding pleasant stimulations. This area is also known to be activated by both opioid analgesia and placebo. Together with these prior results, our finding furthers the understanding of the basis for positive TM treatment effects.

Copyright © 2011 Elsevier Inc. All rights reserved.

137

137

Affective Touch and The Brain

Very little is known about the representation of **affectively pleasant touch** in the brain

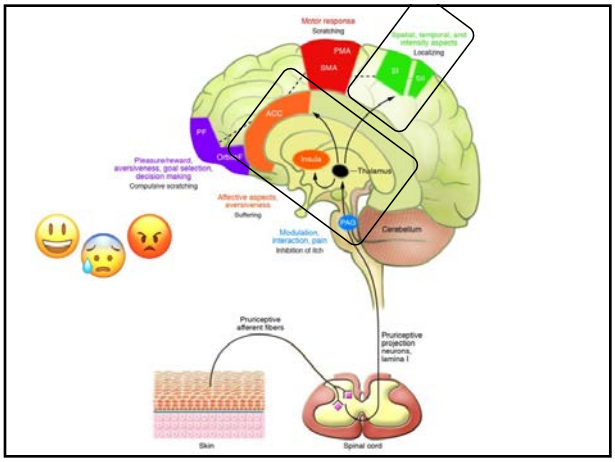
Examples of Affective Touch:

- Mother-infant interactions
- Grooming
- Play
- Sexual behavior
- Texture of food in the mouth

Vallbo A˙ B, Olausson H, Wessberg J: Unmyelinated afferents constitute a second system coding tactile stimuli of the human hairy skin. J Neurophysiol 1999, 81:2753-2763.

138

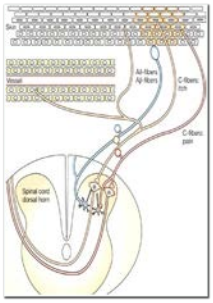
138



139

Subset of C-Fibers (Interoreceptors)

- Part of the **Spinomesencephalic Tract** (Emotional Center)
- Referred to as **Polymodal Sensors**
- Respond more broadly **mechanical** sensory input
  - Very Light Touch
  - Hair Deflection



Found in hairy skin/fascia

140

Dosage Matters – CT Fibers

- **Light** – cotton ball, painters brush, hair deflection (Force 0.04 and 5 millinewtons)
- **Deep Pressure** – Swaddle Approach
- **Slow** – Optimal rate of 3-6 cm/sec
- **Body Temperature**
- **Breathing –** high concentration CT Fibers around the thorax/diaphragm fascia

Liljencrantz et al 2014

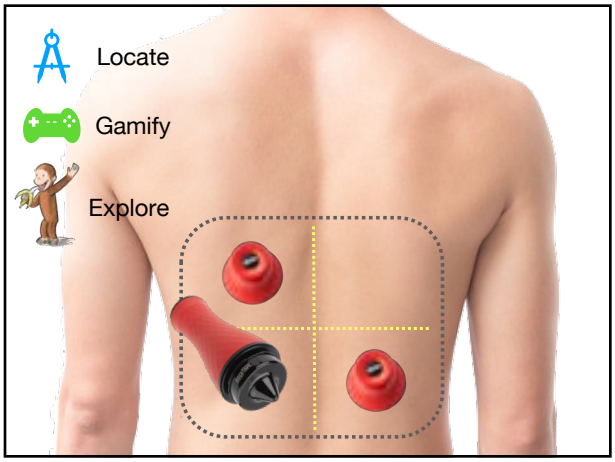
141

Low Risk | Expand Possibilities | Alternate Contingencies

Guided Exploration Approach

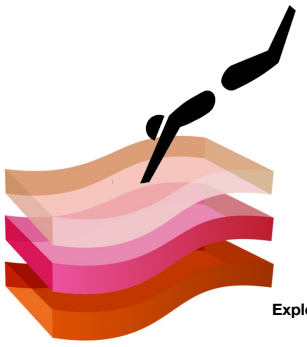
142

142



143

Diving in Under the Skin



Exploring the Experience from **Inside-Out**

144

144

Patient's Job

Intentional Curiosity

- 'Third Person Evaluation'
- The Observer
- What feelings, temperature, textures, intensities, depth, etc.
- Probe deeper and deeper
- Suspend Judgement
- Pay Attention

As the threat meter gets above a 7/10

- Initiate breath release (release valve)

145

Find and Engage the Alarm

Getting the patient/client to use conscious **THINKING** to describe and unconscious **FEELING**:

- **Where is the sensation?** – connect to Area (illuminate it)
- **What size is it?** – seed, grape, apple, cantaloupe, watermelon
- **What shape is it?** – oval, round, square, tubular, irregular
- **How Deep?** - shallow, mid level, deep
- **Quality?** – pain, pressure, ache, soreness
- **Is it empty/hollow, full, overflowing?**
- **Is it solid, liquid, or gas?**
- **Does it have a temperature?** – hot, warm, cool, cold, freezing
- **Does it have a color?**
- **Is it consistent or wavering?**
- **Does it have edges or borders?**
- **Does it stay put or radiate, expand, or move?**

146

Knee - General

147

147

Breakout

Knee/Lower Leg

Locate/Describe

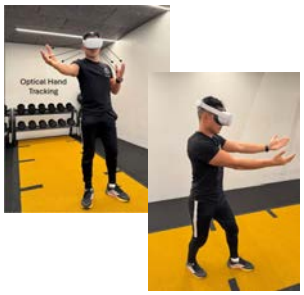
Feel

Curiosity

148

Immersive Rehab

Immersive virtual reality in the rehabilitation of athlete nerve entrapments



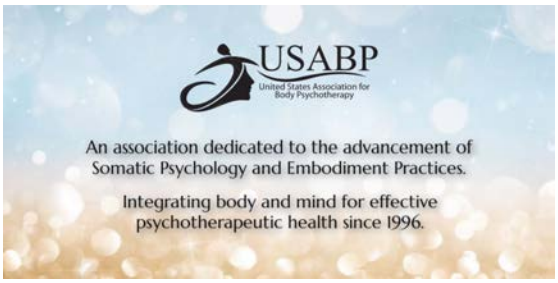
Wenk et al. demonstrated that BOI (**Body Ownership Illusion**) was stronger in an immersive 3D setting compared to a 2D setting.

149

VR Interoceptive Experience

150

Body Psychotherapy Resource



usabp.org

151

151

Psychophysiologic Disorders

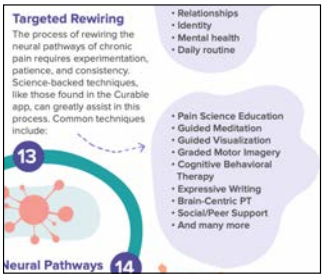
PPDA
Psychophysiologic Disorders Association

ppdassociation.org

152

152

Patient/Client Homework



- **Pain Science** Education
- Guided **Meditation**
- Guided **Visualization**
- Graded **Motor Imagery**
- **CBT** - Cognitive Behavioral Therapy
- **Expressive Writing**
- **Social/Peer Support**

Curable App

153

153

Curiosity Layer Take Homes

1. Listen and Validate
2. **Novel/Safe Stimulus** - extinguishing the prediction error stimulus
3. Productive **Attention** - the 'here and now'
4. Experiential Re-Learning - **New Narratives & Contingencies**
5. Internal Model Software Update - fundamentally changing the experience via a **bottom up** (novel, safe, touch stimulus) and **top down** (reassurance, guidance, correction, education)

154

154

Movement Map - Step 1

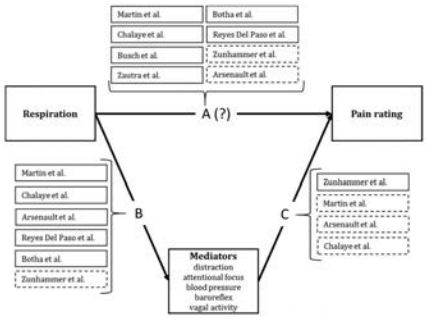
Breath

- Central Pain **Modulation**
- **Emotional** Control
- 1st **Movement Pattern** Stack

155

155

Breathing & Pain Research



154

Jafari, Hassana; Courtois, Imkea; Van den Bergh, Omera; Vlaeyen, Johan W.S.a,b; Van Diest, Ilsea,* Pain and respiration: a systema

156

Pain and Respiration

PSYCHOLOGY, PSYCHIATRY & BRAIN NEUROSCIENCE SECTION

Original Research Articles

The Effect of Deep and Slow Breathing on Pain Perception, Autonomic Activity, and Mood Processing—An Experimental Study

- Relaxation response may constitute the biologically and clinically effective component of breathing techniques, additionally influencing **mood processing**

Busch V, Magerl W, Kern U, Haas J, Hajak G, Eichhammer P. The effect of deep and slow breathing on pain perception, autonomic

157

Behavioral Interface

"respiration may be considered a **behavioral interface** to change autonomic discharge patterns and central mechanisms known to **modulate pain**"

Jafari, Hassan[a]; Courtois, Imke[a]; Van den Bergh, Omer[a]; Vlaeyen, Johan W.S.[a,b]; Van Diest, Ilse[a,*] Pain and respiration: a syste

158

Sigh of Relief

- Both animal and human research have revealed important associations between **sighs and relief.** **6-12/Hr**
- The **pain experience** is highly connected to its **emotional** context.
- Sighing appears to be a marker of **relief of tension**, perceived **negative affect**, restlessness, and stress
- Sighs could be considered an **emotion regulation** mechanism

Vlemincx E, Abelson JL, Lehrer PM, Davenport PW, Van Diest I, Van den Bergh O. Respiratory variability and sighing: A psychophysiological reset model. Biol Psychol. 2013;93(1):24–32.

159

159

Sigh of Relief

- Consistent evidence supports the hypothesis that **sighs** operate as general **psychophysiological resetters** and serve regulatory functions

Vlemincx E, Abelson JL, Lehrer PM, Davenport PW, Van Diest I, Van den Bergh O. Respiratory variability and sighing: A psychophysiological reset model. Biol Psychol. 2013;93(1):24–32.

160

160

The Process - Intentional Sigh

Quick Sniff
Via Nose **(1)**

Normal Inhale
Via Nose **(3)**

Extended 'Sigh'
Exhale with Pause
Via Mouth **(7)**

Li, Peng & Yackle, Kevin. Quick Guide: Sighing. Current Biology 27, R83–R102, February 6, 2017

161

161

Shoulder Frame + Breath

- Position - Supine/Prone
- Application:
  - Frame the Target Area
  - 2-3 Intentional Sighs/Minute:
    i. **Normal Inhale** through nose
    ii. **Short Sniff** (HyperInflation) through nose
    iii. **Long Exhale** (Sigh) through open mouth

162

162

Movement Map - Step 2

Explore

- **Safe** (Low Risk) Patterns
- Develop **New Contingency** Plans
- **Reduce** Threat

163

163

Treat + Move

Comb the area while moving through a meaningful pattern of movement that is complicated by pain.

Meaningful Movement

164

Yoga Pattern

165

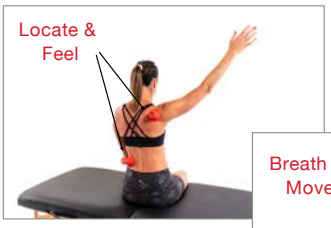
165

Extension Pattern

Sciatic Pattern
Back Chain

166

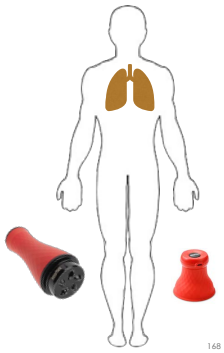
Reaching Pattern



167

Recap of Layered Approach

1. Connect with Stimulus
2. Interpret/Curiosity
3. Breath Stack
4. Movement - Explore



168

Curiosity for the Win

Be an integrator vs operator

Thank you for listening to **my story!**

169

Be The Pig

Thank You

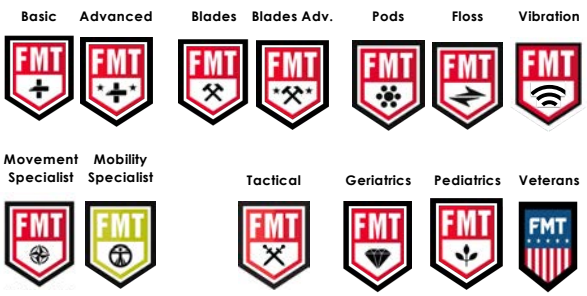
steve@rocktape.com

www.fmtplus.com

@themovementadvocate

170

Functional Movement Training Certifications



171