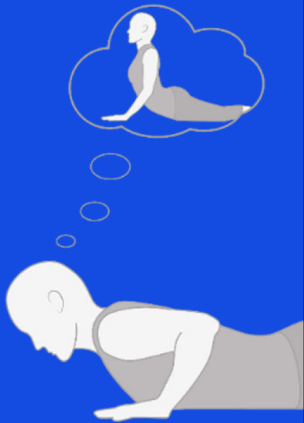
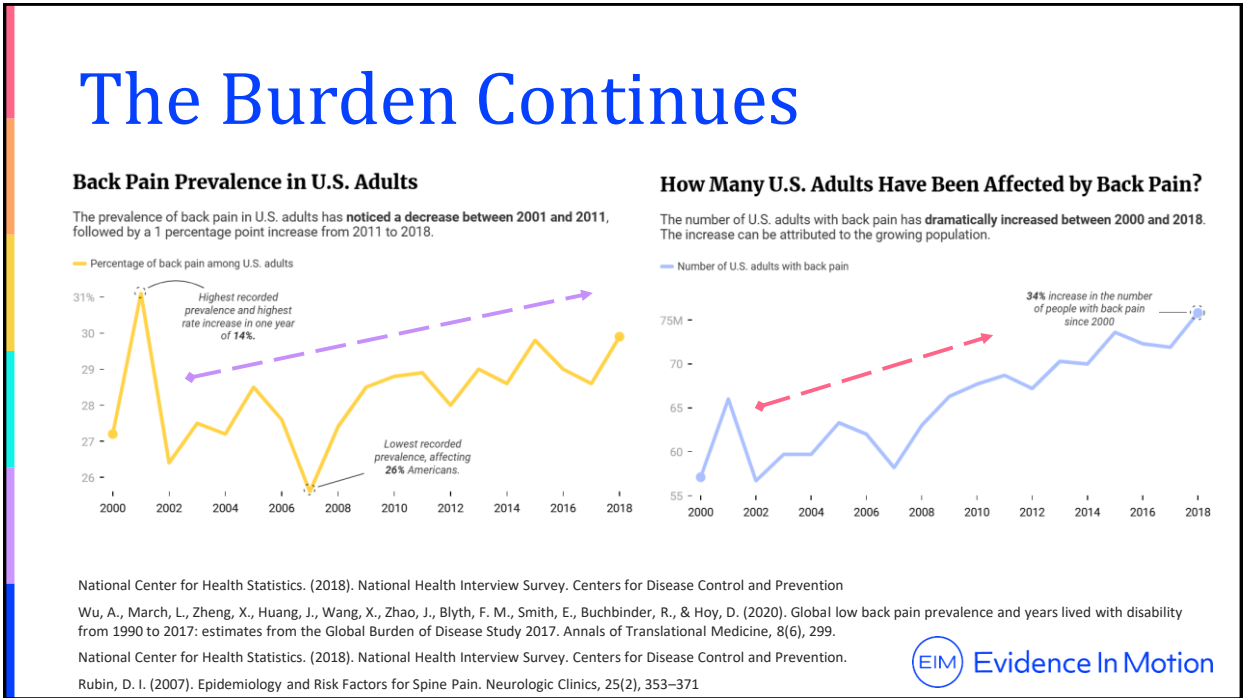


Everyone Can Use Graded Motor Imagery To Help Ease Chronic Low Back Pain

Adriaan Louw, PT, PhD

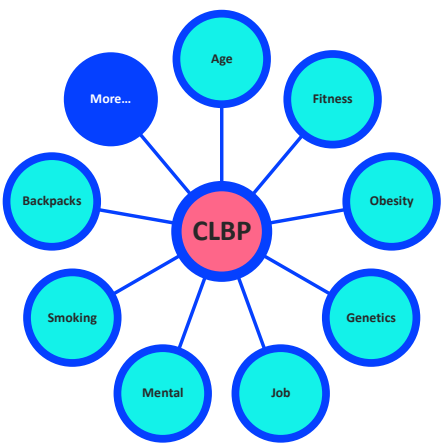


1



2

Numerous Risk Factors...



Vassilaki, M., & Hurwitz, E. L. (2014). Insights in Public Health: Perspectives on Pain in the Low Back and Neck: Global Burden, Epidemiology, and Management. *Hawaii Journal of Medicine and Public Health*, 73(4), 122–126

National Institute of Neurological Disorders and Stroke. (2020). Low Back Pain Fact Sheet. National Institutes of Health

Citko, A., Górski, S., Marcinowicz, L., & Górski, A. (2018). Sedentary Lifestyle and Nonspecific Low Back Pain in Medical Personnel in North-East Poland. *BioMed Research International*, 2018 Smoking Hurts Your Back. (2013). University of Rochester Medical Center

Wu, A., March, L., Zheng, X., Huang, J., Wang, X., Zhao, J., Blyth, F. M., Smith, E., Buchbinder, R., & Hoy, D. (2020). Global low back pain prevalence and years lived with disability from 1990 to 2017: estimates from the Global Burden of Disease Study 2017. *Annals of Translational Medicine*, 8(6), 299.

National Center for Health Statistics. (2018). National Health Interview Survey. Centers for Disease Control and Prevention.

Rubin, D. I. (2007). Epidemiology and Risk Factors for Spine Pain. *Neurologic Clinics*, 25(2), 353–371

The US Burden of Disease Collaborators. (2018). The State of US Health, 1990–2016: Burden of Diseases, Injuries, and Risk Factors Among US States. *JAMA*, 319(14), 1444–1472

Guin, K. (2018). Back Pain Treatment Costs, Opioid Use Drop When Patients Seek Immediate Care. University of Central Florida.

Fritz, J. M., Brennan, G. P., & Hunter, S. J. (2015). Physical Therapy or Advanced Imaging as First Management Strategy Following a New Consultation for Low Back Pain in Primary Care: Associations with Future Health Care Utilization and Charges. *Health Services Research*, 50(6), 1927–1940

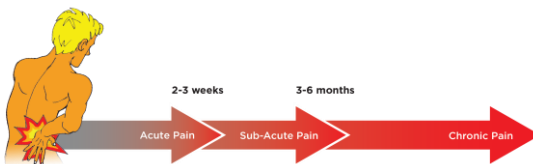
Ibrahim, M. E., Weber, K., Courvoisier, D. S., & Genevay, S. (2019). Recovering the capability to work among patients with chronic low back pain after a four-week, multidisciplinary biopsychosocial rehabilitation program: 18-month follow-up study. *BMC Musculoskeletal Disorders*, 20

da Silva, T., Mills, K., Brown, B. T., Pocovi, N., de Campos, T., Maher, C., & Hancock, M. J. (2019). Recurrence of low back pain is common: a prospective inception cohort study. *Journal of Physiotherapy*, 65(3), 159–165

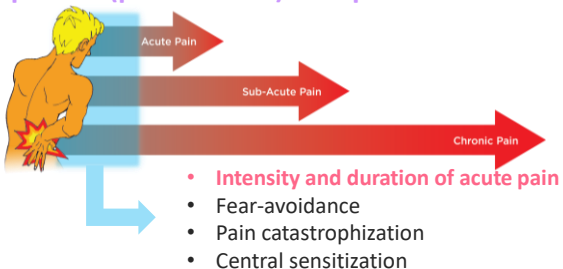
3

Risk Stratification

Traditional viewpoint...



Updated (pain science) viewpoint...



Klyne, D. M., et al. (2019). "Are Signs of Central Sensitization in Acute Low Back Pain a Precursor to Poor Outcome?" *J Pain* 20(8): 994-1009.

Woolf, C. J. (2007). "Central sensitization: uncovering the relation between pain and plasticity." *Anesthesiology* 106(4): 864-867.

Stavrinou, M. L., et al. (2007). "Temporal dynamics of plastic changes in human primary somatosensory cortex after finger webbing." *Cereb Cortex* 17(9): 2134-2142.

Moseley, G. L., et al. (2014). "Intense pain soon after wrist fracture strongly predicts who will develop complex regional pain syndrome: prospective cohort study." *The journal of pain : official journal of the American Pain Society* 15(1): 16-23.

Beggs, S., et al. (2010). "Peripheral nerve injury and TRPV1-expressing primary afferent C-fibers cause opening of the blood-brain barrier." *Molecular pain* 6: 74.

Archer, K. R., et al. (2014). "Early postoperative fear of movement predicts pain, disability, and physical health six months after spinal surgery for degenerative conditions." *The spine journal : official journal of the North American Spine Society* 14(5): 759-767.

Moseley, G. L. and J. W. Vlaeyen (2015). "Beyond nociception: the imprecision hypothesis of chronic pain." *Pain* 156(1): 35-38.

Traeger, A. C., et al. (2015). "Effect of Primary Care-Based Education on Reassurance in Patients With Acute Low Back Pain: Systematic Review and Meta-analysis." *JAMA internal medicine* 175(5): 733-743.

Williams, C. M., et al. (2014). "Predicting rapid recovery from acute low back pain based on the intensity, duration and history of pain: a validation study." *European journal of pain* 18(8): 1182-1189.

4

What About?

- Expectation of pain...
- Radiculopathy...
- Pregnancy...
- Aging...
- Obesity...
- Immobilization...
- Anesthesia...
- Surgery...



Why?

- Expectation of pain...
 - Radiculopathy...
 - Pregnancy...
 - Aging...
- Obesity...
 - Immobilization...
 - Anesthesia...
 - Surgery...

All of these “LBP” issues have been tied to altered cortical maps in the brain which is associated with the development and maintenance of... **CLBP**

Beales D, Lutz A, Thompson J, Wand BM, O'Sullivan P. Disturbed body perception, reduced sleep, and kinesiophobia in subjects with pregnancy-related persistent lumbopelvic pain and moderate levels of disability: An exploratory study. *Manual therapy*. Feb 2016;21:69-75.

Falling C, Mani R. Ageing and obesity indices influences the tactile acuity of the low back regions: A cross-sectional study. *Manual therapy*. Jun 2016;23:25-31.

Moseley GL. I can't find it! Distorted body image and tactile dysfunction in patients with chronic back pain. *Pain*. Nov 15 2008;140(1):239-243.

Louw A. Treating the brain in chronic pain. In: C FdIP, J C, Dommerholt J, eds. *Manual Therapy for Musculoskeletal Pain Syndromes*. Vol 1. London: Churchill Livingstone; 2015

Stenekes, M. W., et al. (2009). "Effects of motor imagery on hand function during immobilization after flexor tendon repair." *Arch Phys Med Rehabil* 90(4): 553-559.

Toussaint, L. and A. Meugnot (2013). "Short-term limb immobilization affects cognitive motor processes." *J Exp Psychol Learn Mem Cogn* 39(2): 623-632.

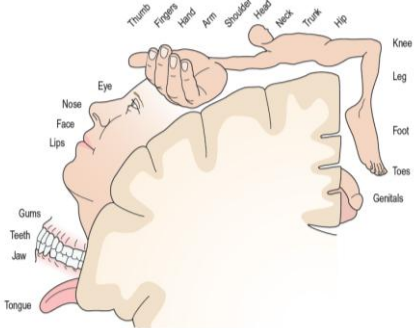
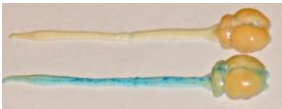
Meugnot, A., et al. (2014). "The embodied nature of motor imagery processes highlighted by short-term limb immobilization." *Exp Psychol* 61(3): 180-186.

Bassolino, M., et al. (2014). "Training the motor cortex by observing the actions of others during immobilization." *Cereb Cortex* 24(12): 3268-3276.

von Piekartz H, Mohr G. Reduction of head and face pain by challenging lateralization and basic emotions: a proposal for future assessment and rehabilitation strategies. *J Man Manip Ther*. Feb 2014;22(1):24-35.

Cortical Changes (Structural Brain)

- Biologically coded
- Environmentally sculpted
- Changes occur fast
- ? Trigger: peripheral neuropathic pain followed by immune response



Biran, I., et al. (2022). Body Structural Description Impairment in Complex Regional Pain Syndrome Type I. *Frontiers in psychology*, 13, 853641.

Pietro, F. D., et al. (2016). An exploration into the cortical reorganisation of the healthy hand in upper-limb complex regional pain syndrome. *Scandinavian journal of pain*, 13, 18–24.

Trojan, J., Speck, V., Kleinböhl, D., Benrath, J., Flor, H., & Maihöfner, C. (2019). Altered tactile localization and spatiotemporal integration in CRPS patients. *European journal of pain*, 23(3), 472–482.

Harden, R. N., McCabe, C. S., Goebel, A., Massey, M., Suvar, T., Grieve, S., & Bruehl, S. (2022). *Complex Regional Pain Syndrome: Practical Diagnostic and Treatment Guidelines*, 5th Edition. Pain medicine (Malden, Mass.), 23(Suppl 1), S1–S53.

Abu-Arafeh, H., & Abu-Arafeh, I. (2017). Complex regional pain syndrome in children: a systematic review of clinical features and movement disorders. *Pain management*, 7(2), 133–140.

Image - Louw A. Treating the brain in chronic pain. In: C FdIP, J C, Dommerholt J, eds. *Manual Therapy for Musculoskeletal Pain Syndromes*. Vol 1. London: Churchill Livingstone; 2015

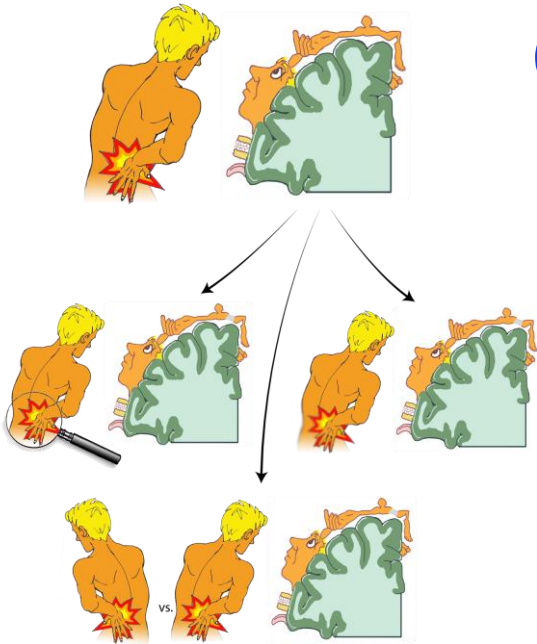
Beggs S, Liu XJ, Kwan C, Salter MW. Peripheral nerve injury and TRPV1-expressing primary afferent C-fibers cause opening of the blood-brain barrier. *Mol Pain*. 2010;6:74.



7

Cortical Changes (Structural Brain)

With decreased movement...



García-Dopico N, Terrasa JL, González-Roldán AM, Velasco-Roldán O, Sitges C. Unraveling the Left-Right Judgment Task in Chronic Low Back Pain: Insights Through Behavioral, Electrophysiological, Motor Imagery, and Bodily Disruption Perspectives. *The Journal of Pain*. 2024;25(7)doi:10.1016/j.jpain.2024.01.349

Zimney KJ, Wassinger CA, Goranson J, Kingsbury T, Kuhn T, Morgan S. The reliability of card-based and tablet-based left/right judgment measurements. *Musculoskelet Sci Pract*. Feb 2018;33:105-109. doi:10.1016/j.msksp.2017.09.002

Bray H, Moseley GL. Disrupted working body schema of the trunk in people with back pain. *Br J Sports Med*. Mar 2011;45(3):168-173.

Maihöfner C, Handwerker HO, Neundörfer B, Birklein F. Patterns of cortical reorganization in complex regional pain syndrome. *Neurology*. December 23, 2003, 2003;61(12):1707-1715.

Moseley GL, Gallagher L, Gallace A. Neglect-like tactile dysfunction in chronic back pain. *Neurology*. Jul 24, 2012;79(4):327-332.

Moseley GL. I can't find it! Distorted body image and tactile dysfunction in patients with chronic back pain. *Pain*. Nov 15, 2008;140(1):239-243.

Flor H. The functional organization of the brain in chronic pain. *Prog Brain Res*. 2000;129:313-322



8

Cortical Changes (Structural Brain)

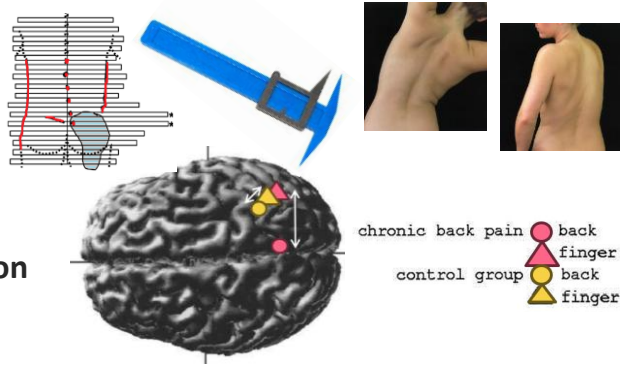
Chronic LBP: Laterality

- Bilateral back pain: 53% (44%-62%)
- Unilateral back pain: 67% (60%-74%)
- Controls: 87% (75%-98%)

Chronic LBP: Size changes

Chronic LBP: Two-Point Discrimination

- Normal: 5.5 cm; CLBP: ~11 cm



García-Dopico N, Terrasa JL, González-Roldán AM, Velasco-Roldán O, Sitges C. Unraveling the Left-Right Judgment Task in Chronic Low Back Pain: Insights Through Behavioral, Electrophysiological, Motor Imagery, and Bodily Disruption Perspectives. *The Journal of Pain*. 2024;25(7):doi:10.1016/j.jpain.2024.01.349

Zimney KJ, Wassinger CA, Goranson J, Kingsbury T, Kuhn T, Morgan S. The reliability of card-based and tablet-based left/right judgment measurements. *Musculoskelet Sci Pract*. Feb 2018;33:105-109. doi:10.1016/j.msksp.2017.09.002

Bray H, Moseley GL. Disrupted working body schema of the trunk in people with back pain. *Br J Sports Med*. Mar 2011;45(3):168-173.

Maihöfner C, Handwerker HO, Neundörfer B, Birklein F. Patterns of cortical reorganization in complex regional pain syndrome. *Neurology*. December 23, 2003; 2003;61(12):1707-1715.

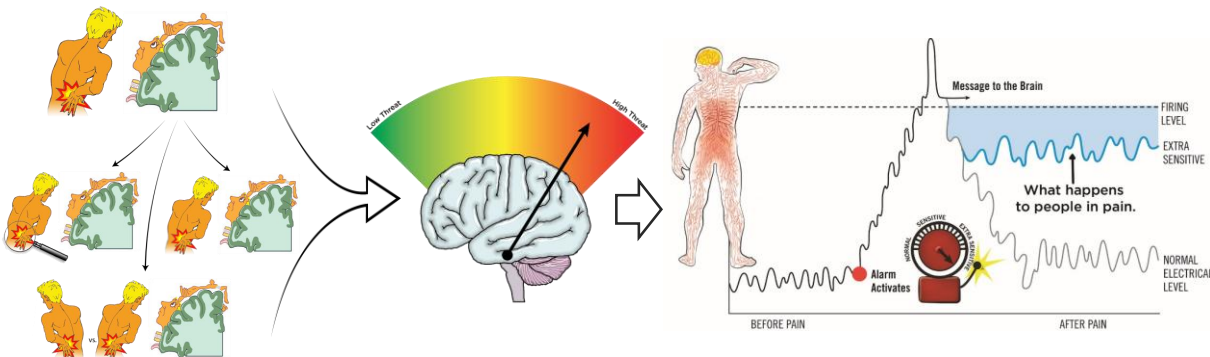
Flor H. The functional organization of the brain in chronic pain. *Prog Brain Res*. 2000;129:313-322

Moseley GL, Gallagher L, Gallace A. Neglect-like tactile dysfunction in chronic back pain. *Neurology*. Jul 24, 2012;79(4):327-332.

Moseley GL. I can't find it! Distorted body image and tactile dysfunction in patients with chronic back pain. *Pain*. Nov 15, 2008;140(1):239-243.

9

Cortical Changes (structural brain)



García-Dopico N, Terrasa JL, González-Roldán AM, Velasco-Roldán O, Sitges C. Unraveling the Left-Right Judgment Task in Chronic Low Back Pain: Insights Through Behavioral, Electrophysiological, Motor Imagery, and Bodily Disruption Perspectives. *The Journal of Pain*. 2024;25(7):doi:10.1016/j.jpain.2024.01.349

Zimney KJ, Wassinger CA, Goranson J, Kingsbury T, Kuhn T, Morgan S. The reliability of card-based and tablet-based left/right judgment measurements. *Musculoskelet Sci Pract*. Feb 2018;33:105-109. doi:10.1016/j.msksp.2017.09.002

Moseley GL, Gallagher L, Gallace A. Neglect-like tactile dysfunction in chronic back pain. *Neurology*. Jul 24, 2012;79(4):327-332.



10



What Should We Look For?

Central Sensitization

Altered body maps

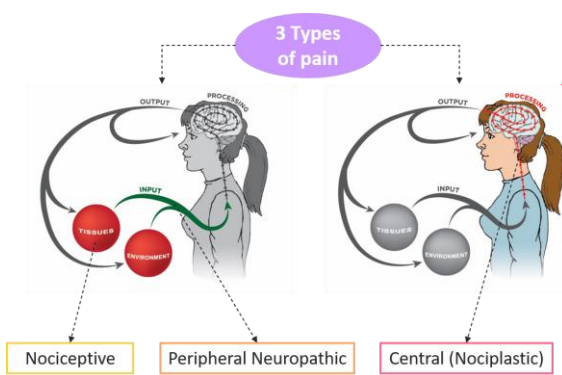
Subjectively

Objectively



11

Central Sensitization (Nociplastic Pain)



3 Types of pain

Symptom and sign cluster: 486 times more likely

☐ Disproportionate pain

☐ Disproportionate aggravating and easing factors

☐ Diffuse palpation tenderness

☐ Psychosocial issues

- ☐ Fear-avoidance
- ☐ Pain Catastrophizing
- ☐ Depression

Nociceptive

Peripheral Neuropathic

Central (Nociplastic)

Smart KM, Blake C, Staines A, Thacker M, Doody C. Mechanisms-based classifications of musculoskeletal pain: Part 1 of 3: Symptoms and signs of central sensitisation in patients with low back (+/-leg) pain. Manual therapy. Aug 2012;17(4):336-344.

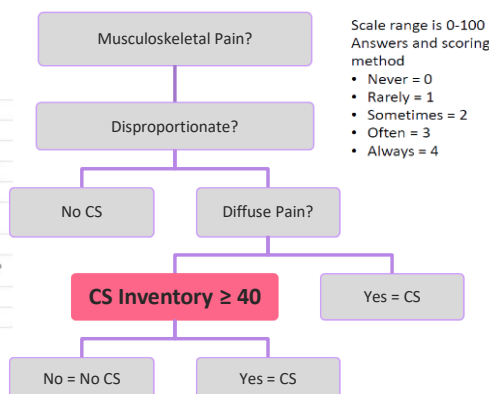


12

Central Sensitization (Nociplastic Pain)

Central Sensitization Inventory (CSI)

- | | |
|--|---|
| 1. I feel tired and unrefreshed when I wake from sleeping. | 14. I have skin problems such as dryness, itchiness, or rashes. |
| 2. My muscles feel stiff and achy. | 15. Stress makes my physical symptoms get worse. |
| 3. I have anxiety attacks. | 16. I feel sad or depressed. |
| 4. I grind or clench my teeth. | 17. I have low energy. |
| 5. I have problems with diarrhea and/or constipation. | 18. I have muscle tension in my neck and shoulders. |
| 6. I need help in performing my daily activities. | 19. I have pain in my jaw. |
| 7. I am sensitive to bright lights. | 20. Certain smells, such as perfumes, make me feel dizzy and nauseated. |
| 8. I get tired very easily when I am physically active. | 21. I have to urinate frequently. |
| 9. I feel pain all over my body. | 22. My legs feel uncomfortable and restless when I am trying to go to sleep at night. |
| 10. I have headaches. | 23. I have difficulty remembering things. |
| 11. I feel discomfort in my bladder and/or burning when I urinate. | 24. I suffered trauma as a child. |
| 12. I do not sleep well. | 25. I have pain in my pelvic area. |
| 13. I have difficulty concentrating. | |



Mayer TG, Neblett R, Cohen H, et al. The development and psychometric validation of the central sensitization inventory. *Pain Pract.* Apr 2012;12(4):276-285.

Nijs J, Van Houdenhove B, Oostendorp RA. Recognition of central sensitization in patients with musculoskeletal pain: Application of pain neurophysiology in manual therapy practice. *Man Ther.* Apr 2010;15(2):135-141.

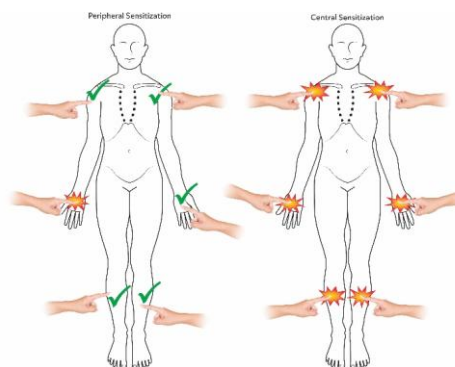
EIM Evidence In Motion

13

Central Sensitization (Nociplastic Pain)

Clinical examination of patients with suspected central sensitization:

1. Assessment of pressure pain thresholds at sites **remote** from the symptomatic site
2. Assessment of sensitivity to touch during manual palpation at sites **remote** from the symptomatic site
3. Assessment of sensitivity to vibration at sites **remote** from the symptomatic site
4. Assessment of sensitivity to heat or cold at sites **remote** from the symptomatic site
5. Assessment of pressure pain thresholds during and following exercise
6. Assessment of joint end-feel
7. Neurodynamic test



Nijs J, Van Houdenhove B, Oostendorp RA. Recognition of central sensitization in patients with musculoskeletal pain: Application of pain neurophysiology in manual therapy practice. *Manual therapy.* Apr 2010;15(2):135-141.

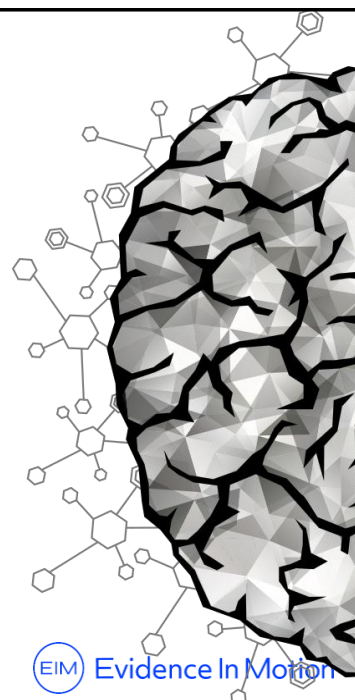
EIM Evidence In Motion

14

Altered Body Maps

Clinical Clues

- ✓ Persistent pain
- ✓ Increased sensitization – hyperalgesia and/or allodynia
- ✓ Spreading pain
- ✓ Mirror pain (left and right)
- ✓ Decreased awareness of the back
- ✓ Decreased proprioceptive positioning of the back
- ✓ Size discrepancies – larger/smaller
- ✓ Experiencing pain outside/alongside back
- ✓ Temperature changes
- ✓ Other

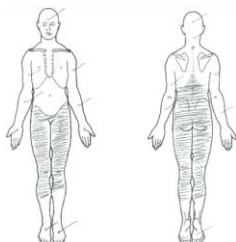


15

Altered Body Maps

1. Body Chart

- Quick, easy screen
- Non-invasive



2. Laterality

- Flash cards
 - Recognise™
 - Orientate Free
- Normal:
- >80% accuracy
 - Less than 3 seconds/image



3. Localization

- Nine-block grid
 - Random touch
 - Localize palpation
- Normal:
- 80% accuracy



4. Two-Point Discrimination

- Ability to discriminate how far 2 points are from each other (tactile)
- Normative data (addendum)



EIM Evidence In Motion

16

Rx: Graded Motor Imagery

- Structured, sequential series of cortical exercises, aimed at reestablishing cortical changes in patients with the intent of decreasing central sensitization and the pain experience
- The test becomes...the treatment



GMI has been shown to decrease pain and sensitivity and improve movement and function in CS-dominant clinical presentations such as CRPS, **chronic low back pain** and phantom limb pain

Xie, H. M., et al. (2022). "Effectiveness of Mirror Therapy for Phantom Limb Pain: A Systematic Review and Meta-analysis." Arch Phys Med Rehabil 103(5): 988-997.

Wang, F., et al. (2021). "Effects of mirror therapy on phantom limb sensation and phantom limb pain in amputees: A systematic review and meta-analysis of randomized controlled trials." Clin Rehabil 35(12): 1710-1721.

Limakatso, K., et al. (2020). "The effectiveness of graded motor imagery for reducing phantom limb pain in amputees: a randomised controlled trial." Physiotherapy 109: 65-74.

Daly AE, Bialocerkowski AE. Does evidence support physiotherapy management of adult Complex Regional Pain Syndrome Type One? A systematic review. European journal of pain (London, England). Apr 2009;13(4):339-353.

Bowering KJ, O'Connell NE, Tabor A, et al. The effects of graded motor imagery and its components on chronic pain: a systematic review and meta-analysis. The journal of pain : official journal of the American Pain Society. Jan 2013;14(1):3-13.

Moseley GL. Graded motor imagery for pathologic pain: a randomized controlled trial. Neurology. Dec 26 2006;67(12):2129-2134.

17

Sequence?

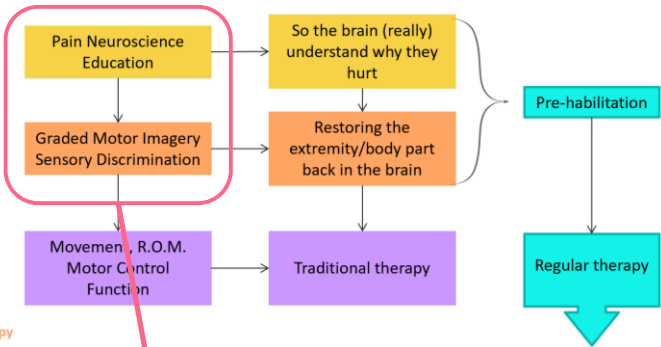
It may work best if carried out in the sequence of:

- Laterality recognition
- Motor imagery
- Mirror therapy
- But...

PNE Laterality Motor Imagery Sensory Discrimination Mirror Therapy

Not Complicated
No Sequence

Complicated Sequence ← **CRPS**



Moseley GL. Graded motor imagery for pathologic pain: a randomized controlled trial. Neurology. Dec 26 2006;67(12):2129-2134.

Louw A, Louw C, Zimney K. Why Are My Nerves So Sensitive? Minneapolis, MN: OPTP; 2014.



18

CLBP Rx: 1. Education

> 3 Dozen Systematic Reviews:

✓ Pain ratings

✓ Pain knowledge

✓ Disability

✓ Pain catastrophizing

✓ Fear-avoidance

✓ Attitudes, beliefs & behaviors regarding pain

✓ Physical movement

✓ Healthcare utilization/cost

PNE NNT superior to current “gold-standard” medication for chronic pain

3:1
PNE NNT for pain

6:1
Gabapentin NNT for pain

7:1
Antidepressant (SSRI) NNT for pain

Nunez-Cortes, R., et al. (2024). "The optimal dose of pain neuroscience education added to an exercise programme for patients with chronic spinal pain: a systematic review and dose-response meta-analysis." *Pain* 165(6): 1196-1206.

Lin, L. H., et al. (2024). "Pain neuroscience education for reducing pain and kinesiophobia in patients with chronic neck pain: A systematic review and meta-analysis of randomized controlled trials." *Eur J Pain* 28(2): 231-243.

Salazar-Mendez, J., et al. (2023). "Dosage matters: Uncovering the optimal duration of pain neuroscience education to improve psychosocial variables in chronic musculoskeletal pain. A systematic review and meta-analysis with moderator analysis." *Neurosci Biobehav Rev* 153: 105328.

Louw A, Zimney K, Puentedura EJ, Diener I. The efficacy of pain neuroscience education on musculoskeletal pain: A systematic review of the literature. *Physiotherapy Theory and Practice*. Jul 2016;32(5):332-355.

Wood, L. and P. A. Hendrick (2019). "A systematic review and meta-analysis of pain neuroscience education for chronic low back pain: Short- and long-term outcomes of pain and disability." *Eur J Pain* 23(2): 234-249.

Watson, J. A., et al. (2019). "Pain Neuroscience Education for Adults With Chronic Musculoskeletal Pain: A Mixed-Methods Systematic Review and Meta-Analysis." *J Pain*.

Maffliet, A., et al. (2018). "Effect of Pain Neuroscience Education Combined With Cognition-Targeted Motor Control Training on Chronic Spinal Pain: A Randomized Clinical Trial." *JAMA Neurol* 75(7): 808-817.

Romm, M. J., et al. (2021). "A Meta-Analysis of Therapeutic Pain Neuroscience Education, Using Dosage and Treatment Format as Moderator Variables." *Pain Pract* 21(3): 366-380.

Siddall, B., et al. (2021). "Short-term impact of combining pain neuroscience education with exercise for chronic musculoskeletal pain: a systematic review and meta-analysis." *Pain*.

Suso-Marti, L., et al. (2022). "Effectiveness of Pain Neuroscience Education in Patients with Fibromyalgia: A Systematic Review and Meta-Analysis." *Pain Med* 23(11): 1837-1850.

Ordonez-Mora, L. T., et al. (2022). "Effectiveness of Interventions Based on Pain Neuroscience Education on Pain and Psychosocial Variables for Osteoarthritis: A Systematic Review." *Int J Environ Res Public Health* 19(5).

Saracoglu, I., et al. (2022). "Efficacy of adding pain neuroscience education to a multimodal treatment in fibromyalgia: A systematic review and meta-analysis." *Int J Rheum Dis* 25(4): 394-404.

Moore RA, Wiffen PJ, Derry S, McQuay HJ. Gabapentin for chronic neuropathic pain and fibromyalgia in adults. *The Cochrane database of systematic reviews*. 2011(3):CD007938.

Lynch ME, Watson CP. The pharmacotherapy of chronic pain: a review. *Pain research & management*. Spring 2006;11(1):11-38.

Moseley L. Combined physiotherapy and education is efficacious for chronic low back pain. *Aust J Physiother*. 2002;48(4):297-302.

19

CLBP Rx: 1. Education

Extra Sensitive Alarm System

BEFORE PAIN

AFTER PAIN

Message to the Brain

What happens to people in pain.

BEFORE PAIN

AFTER PAIN

EXTRA SENSITIVE

NORMAL ELECTRICAL LEVEL

whyyouhurt.com

30 free PNE videos, patient and clinician resources

FIRING LEVEL

BEFORE PAIN

AFTER PAIN

EXTRA SENSITIVE

NORMAL ELECTRICAL LEVEL

Louw A, Riera-Gilley V. Pain Neuroscience Education: Teaching People About Pain. *J Pain Palliat Care Pharmacother*. Sep 2024;38(3):292-301.

Louw A, Schuermann T, Zimney K, Puentedura EJ. Pain Neuroscience Education for Acute Pain. *Int J Sports Phys Ther*. 2024;19(6):758-762.

Louw, A., et al. (2016). "The clinical application of teaching people about pain." *Physiotherapy theory and practice* 32(5): 385-395.

Evidence In Motion

20

All rights reserved – not to be copied or used without permission from Adriaan Louw and EIM

10

CLBP Rx: 2. Laterality

- ✓ Flashcards
- ✓ Applications
- ✓ Magazines
- ✓ Hands, feet, knee, shoulder
- ✓ For “hot hands” we use feet and vice versa
- ✓ “Bike” of GMI



von Piekartz H, Mohr G. Reduction of head and face pain by challenging lateralization and basic emotions: a proposal for future assessment and rehabilitation strategies. J Man Manip Ther. Feb 2014;22(1):24-35.

Moseley, G. L. (2004). "Why do people with complex regional pain syndrome take longer to recognize their affected hand?" Neurology 62(12): 2182-2186.

Moseley, G. L., et al. (2005). "Experimental hand pain delays recognition of the contralateral hand--evidence that acute and chronic pain have opposite effects on information processing?" Brain research. Cognitive brain research 25(1): 188-194.

Bray H, Moseley GL. Disrupted working body schema of the trunk in people with back pain. Br J Sports Med. Mar 2011;45(3):168-173.



21

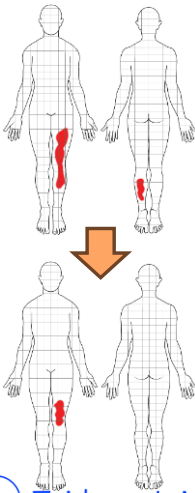
CLBP Rx: 2. Laterality

Laterality often used in parts of GMI treatment for CLBP



Study...in progress

- Chronic MSK (> 3 years)
- Intervention: Laterality
- 5 sets if 20 images with 60 sec. break
- Pre-post:
 - Body maps decrease 38% (p = 0.04) and correlates to increased speed in laterality (r = 0.45).



22

CBLP Rx: 3. Motor Imagery



- Imagine extremity (see it visually)
 - Static
 - Dynamic
 - Doing tasks
- Exercising brain map without moving painful body part

Louw, A., et al. (2022). "Virtual McKenzie extension exercises for low back and leg pain: a prospective pilot exploratory case series." J Man Manip Ther: 1-7.

Scott, M., et al. (2018). "Motor imagery during action observation increases eccentric hamstring force: an acute non-physical intervention." Disabil Rehabil 40(12): 1443-1451.

Kanthack, T. F. D., et al. (2017). "Neurophysiological insights on flexibility improvements through motor imagery." Behav Brain Res 331: 159-168.

Wallwork, S. B., et al. (2015). "Are people who do yoga any better at a motor imagery task

than those who do not?" Br J Sports Med 49(2): 123-127.

Meugnot, A., et al. (2014). "The embodied nature of motor imagery processes highlighted by short-term limb immobilization." Exp Psychol 61(3): 180-186.

Bowering, K. J., et al. (2014). "Motor imagery in people with a history of back pain, current back pain, both, or neither." The Clinical journal of pain 30(12): 1070-1075.



CBLP Rx: 3. Motor Imagery

Practical

- ✓ 10 tasks they want to perform again
- ✓ Print 10 images from the Internet
- ✓ Draw card
- ✓ Imagine static back in that position
- ✓ Imagine moving back to similar position
- ✓ Imagine performing the task
- ✓ Repeat; repeat; repeat



Louw, A., et al. (2022). "Virtual McKenzie extension exercises for low back and leg pain: a prospective pilot exploratory case series." J Man Manip Ther: 1-7.

Scott, M., et al. (2018). "Motor imagery during action observation increases eccentric hamstring force: an acute non-physical intervention." Disabil Rehabil 40(12): 1443-1451.

Kanthack, T. F. D., et al. (2017). "Neurophysiological insights on flexibility improvements through motor imagery." Behav Brain Res 331: 159-168.

Wallwork, S. B., et al. (2015). "Are people who do yoga any better at a motor imagery task

than those who do not?" Br J Sports Med 49(2): 123-127.

Meugnot, A., et al. (2014). "The embodied nature of motor imagery processes highlighted by short-term limb immobilization." Exp Psychol 61(3): 180-186.

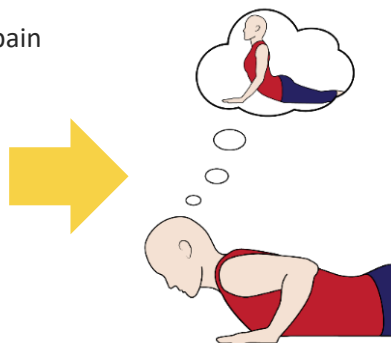
Bowering, K. J., et al. (2014). "Motor imagery in people with a history of back pain, current back pain, both, or neither." The Clinical journal of pain 30(12): 1070-1075.



CBLP Rx: 3. Motor Imagery

Patients

- 10 patients with LBP/leg pain
- Mean duration: 10 weeks
- Mean LBP: 4.5/10
- Mean Leg pain: 3.7/10
- Mean FABQ-PA: 11.7
- Mean FABQ-WS: 15.6
- Mean PCS: 21



Improvement in:

- LBP ($p = 0.029$)
- FABQ-WS ($p = 0.003$)
- PCS ($p = 0.001$)
- Flexion ($p < 0.001$)
- SLR ($p < 0.001$)

Treatment

- 10 x "imagined" extension exercises (guided imagery)

Louw, A., et al. (2022). "Virtual McKenzie extension exercises for low back and leg pain: a prospective pilot exploratory case series." J Man Manip Ther: 1-7.

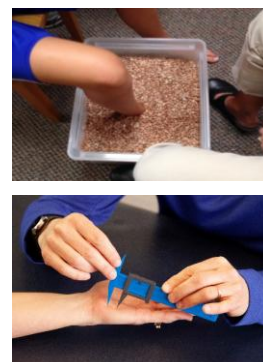
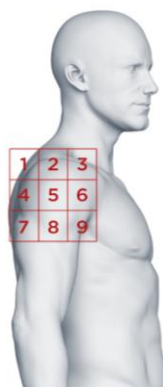


25

CLBP Rx: 4. Sensory Discrimination

Possible strategies:

- Two-point discrimination
- Graphesthesia
- Stereognosis
- Localization
- Sharp; dull
- Textures
- Vibration, sound
- Rice, beans
- Etc.



Moseley GL, Wiech K. The effect of tactile discrimination training is enhanced when patients watch the reflected image of their unaffected limb during training. Pain. Aug 2009;144(3):314-319.

Louw, A., et al. (2017). "Pain and Decreased Range of Motion in Knees and Shoulders: A Brief Sensory Remapping Intervention." Pain and Rehabilitation Summer(43): 20-30.

Catley MJ, O'Connell NE, Berryman C, Ayhan FF, Moseley GL. Is Tactile Acuity Altered in People With Chronic Pain? A Systematic Review and Meta-analysis.

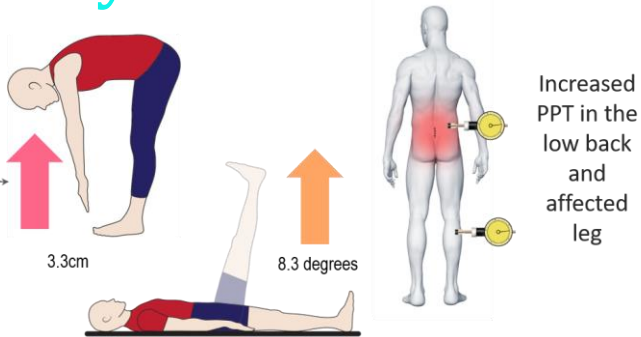
The Journal of Pain. 2014/10// 2014;15(10):985-1000.



26

CLBP Rx: 4. Sensory Discrimination

- A 56-year-old w/discectomy: CLBP and leg pain
- Post-op: Hyperalgesia and fear of movement
- 3 weeks post-op PT; 2x/week
- Sensory discrimination only



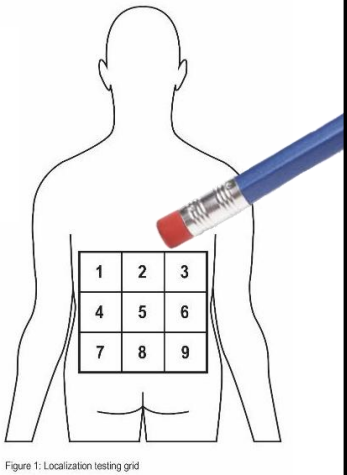
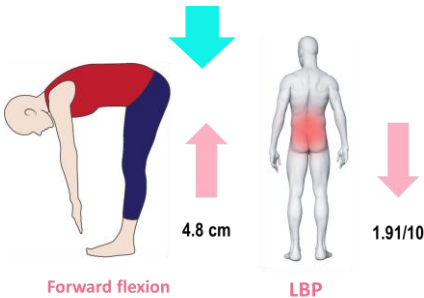
Louw A, Schmidt SG, Louw C, Puenteudura EJ. Moving without moving: immediate management following lumbar spine surgery using a graded motor imagery approach: a case report. Physiotherapy Theory and Practice. Oct 2015;31(7):509-517.



27

CLBP Rx: 4. Sensory Discrimination

- 16 patients with CLBP(~11.9 years)
- Average LBP 5.56 out of 10; Moderate disability (ODI 34.38%)
- High fear-avoidance associated with physical activity
- 5-minute localization; pre- and post treatment measure

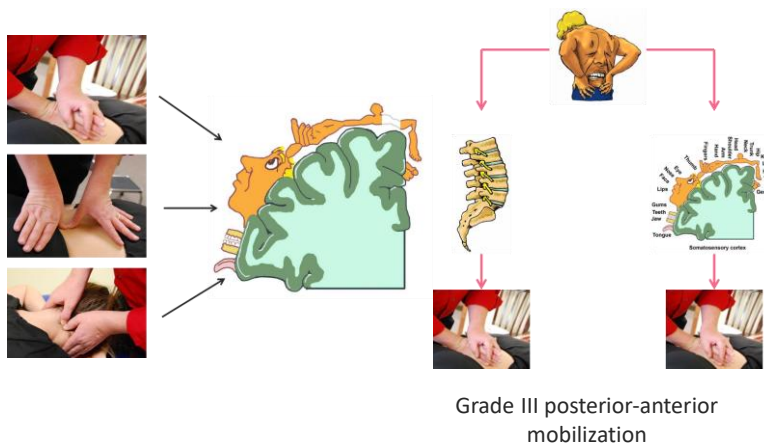


Louw A, Farrell K, Wettach L, Uhl J, Majkowski K, Welding M. Immediate effects of sensory discrimination for chronic low back pain: a case series. New Zealand Journal of Physiotherapy. 2015:60-65.



28

CLBP Rx: 4. Sensory Discrimination



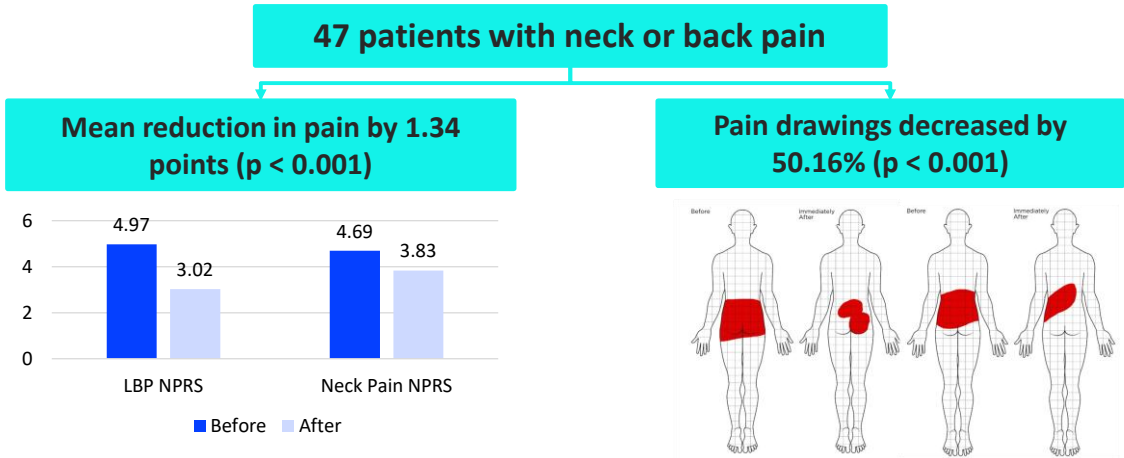
- 62 patients; ~9.26 years of CLBP
- Significant change in favor of neuroplasticity group for SLR ($p = .041$)
 - The neuroplasticity group were 7.2 times (95% confidence interval = 1.8-28.6) more likely to improve beyond the MDC on the SLR than participants in the mechanical group

Louw A, Farrell K, Landers M, et al. The effect of manual therapy and neuroplasticity education on chronic low back pain: a randomized clinical trial. J Man Manip Ther. Dec 2017;25(5):227-234



29

CLBP Rx: 4. Sensory Discrimination



Louw, C., Louw, A., Maywhort, K., Collins, B., Keatts, A., Podolak, J., Louw, H., Cox, T. (2023). "Dry Needling and Pain Drawings: An Exploratory Study." Annals of Physiotherapy and Occupational Therapy 6(1): 1-8.



30

CLBP Rx: 4. Sensory Discrimination

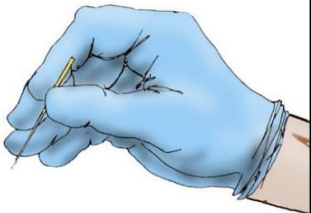
15 patients with CLBP

Expected results

- Reduced LBP 3.33 points (<0.001)
- Improve flexion by 4.07 cm (0.001)
- Improve SLR by 9° (<0.001)

The “cool” part

- Improved laterality accuracy (0.001)
- Improved laterality speed (0.002)
- Improved two-point discrimination (0.003)



O'Neill, M., et al. (2021). "A Case-Series of Dry Needling as an Immediate Sensory Integration Intervention." J Man Manip Ther: 1-7.



31

CLBP Rx: 5. Mirror Therapy

Mirror (visual) feedback (illusion)
used to “trick” the brain:

Back: Camera or 2 standing mirrors



Moseley GL. Using visual illusion to reduce at-level neuropathic pain in paraplegia. *Pain*. Aug 2007;130(3):294-298.

Louw A, PuenteDura EJ, Reese D, Parker P, Miller T, Mintken PE. Immediate Effects of Mirror Therapy in Patients With Shoulder Pain and Decreased Range of Motion. *Arch Phys Med Rehabil*. Oct 2017;98(10):1941-1947.

Rebne, A., Louw, A., Podolak, J., Weber, B., Van Der Geest, C., Hawk, D., Louw, H., Cox, T. (2023). "Mirror Therapy for Total Knee Arthroplasty: A Pilot Study." *Surgery Research Journal* 3(1): 1-7.

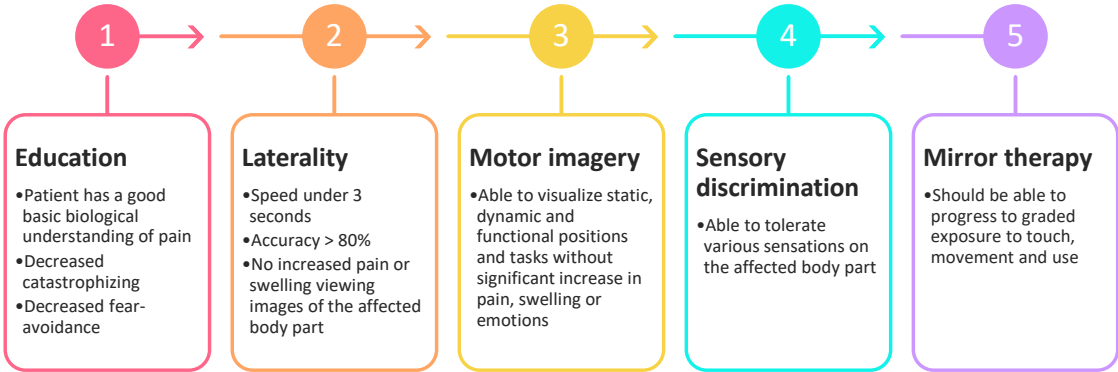
Xie, H. M., et al. (2022). "Effectiveness of Mirror Therapy for Phantom Limb Pain: A Systematic Review and Meta-analysis." *Arch Phys Med Rehabil* 103(5): 988-997.

Wang, F., et al. (2021). "Effects of mirror therapy on phantom limb sensation and phantom limb pain in amputees: A systematic review and meta-analysis of randomized controlled trials." *Clin Rehabil* 35(12): 1710-1721.



32

When to Progress to the Next Phase?



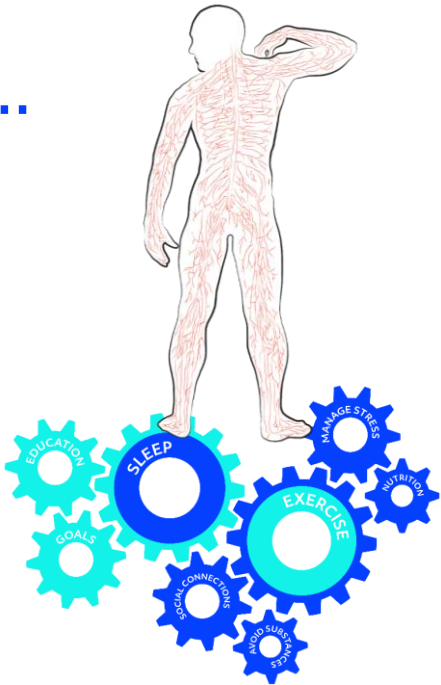
Louw, A. Clinical trial and error. Journal of Clinical Hard Knocks and Observing Patients (2025); 1(1) 1-1



33

During and After GMI...

GMI is localized Rx – also think GLOBAL



34

Take Home Ideas

1. Grid localization: clinic and/or HEP
- 1b. Sharp/Dull: clinic and/or HEP
2. Motor imagery before movement

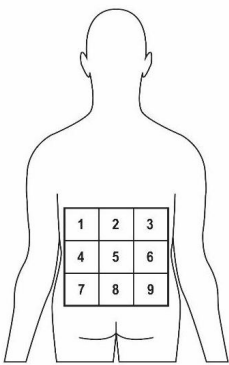
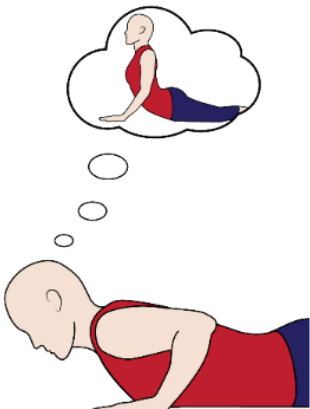


Figure 1: Localization testing grid



Take Home

3. Manual Therapy/DN: sensory discrimination (active brain vs. passive brain)



Where am I touching?

What direction am I going?

Hard or light?

Thank You and Acknowledgements

adriaan@eimpt.com

evidenceinmotion.com

whyyouhurt.com



Colleen Louw
Hailey Louw
Samuel Louw
Louie Puentedura
Kory Zimney
Steve Schmidt
Jessie Podolak
Ina Diener
Jo Nijs
Louis Gifford
David Butler
Terry Cox
EIM staff and faculty



37

Pain Science: Want More?

Educational offerings at EIM



Resources from optp



38