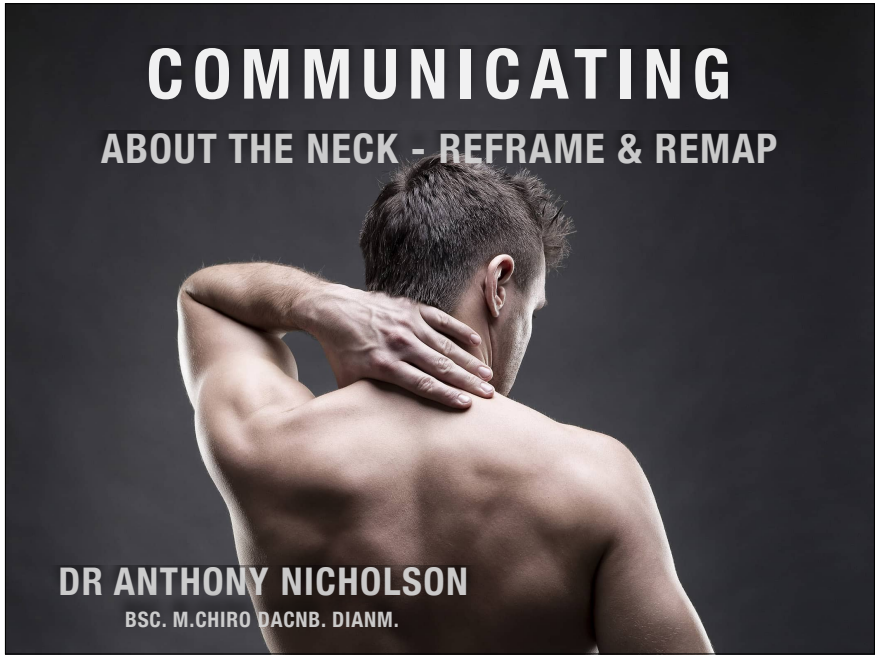



Bob is 65-years-old and has suffered recurrent neck pain for many years. He complains of significant neck stiffness and has difficulty turning his head to the left side, and has noticed an unusual aching sensation in his left parascapular area over recent weeks. Bob tends to succumb to a 'wry neck' every couple of years. Furthermore, he's started to suffer dizzy sensations when looking down to hit a golf ball. He often feels disorientation for a short time afterwards.

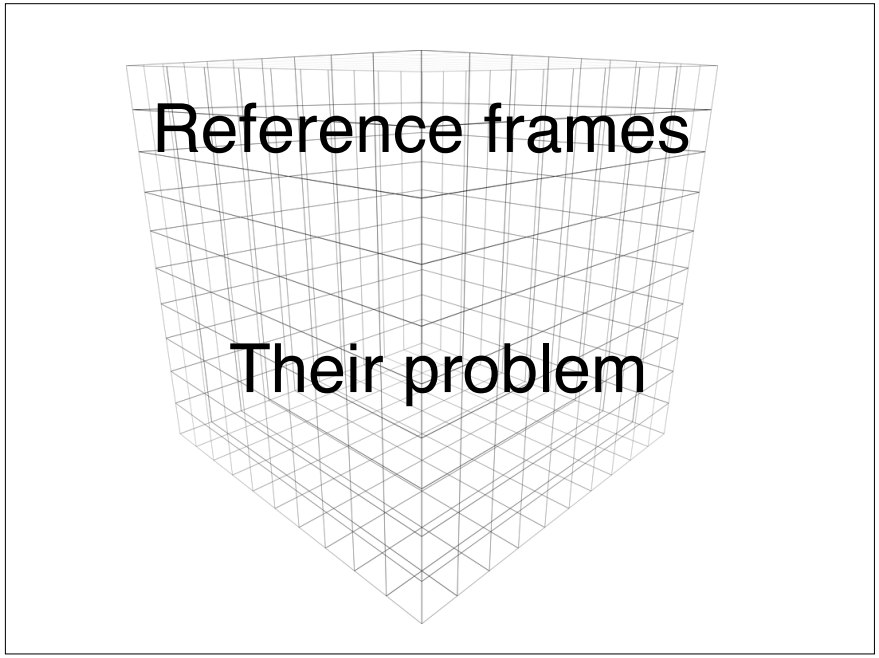
## TOP DOWN - BOTTOM UP

- Pain as a protective behaviour
- Cortical representation (model)
- Balance, posture and sensorimotor control
- Biomechanics and pathoanatomy
- Red flags

## WHAT DO WE MEAN BY:

## ‘RE-FRAME’?

## ‘RE-MAP’?




WE COULD VIEW CHRONIC PAIN AS A FAULTY MODEL IN THE BRAIN

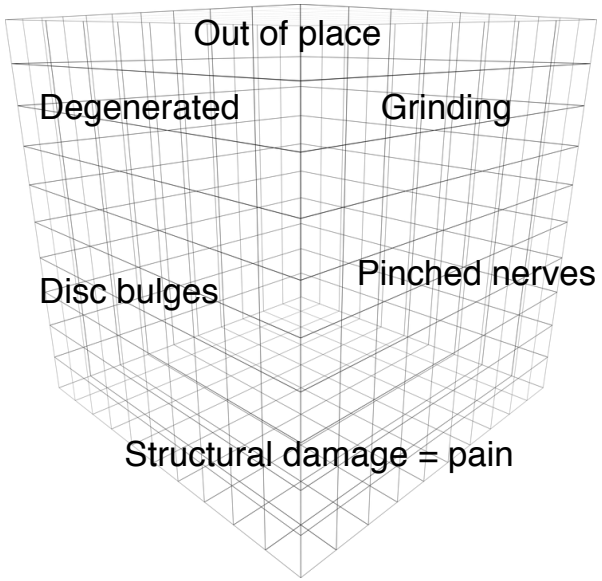
REMEMBER THAT PAIN IS ABOUT MEANING

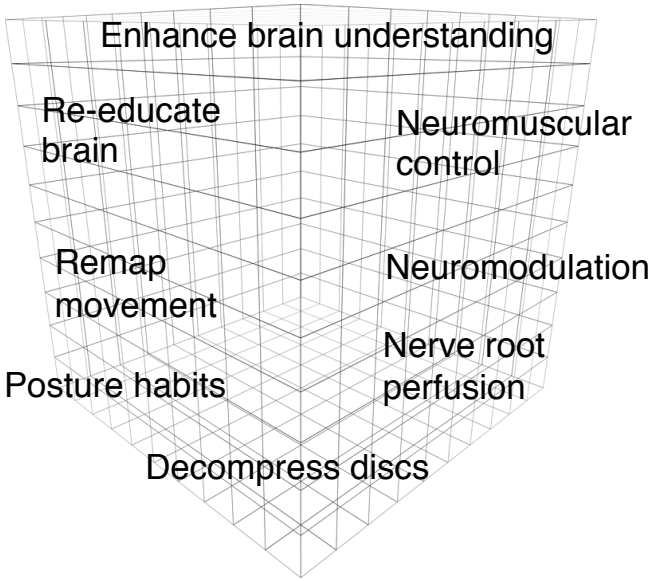
SO WE NEED TO DE-EDUCATE IN ORDER TO RE-EDUCATE

DE-LINK STRUCTURE AND PAIN

RE-LINK PAIN WITH
DE-CONDITIONING AND
PROTECTION

JAMMED MACHINE OR
PROTECTIVE RESPONSE?






# PNE IS ONE OF THE MOST STUDIED 'TOP-DOWN' APPROACHES

Pain neuroscience education (PNE) seeks to challenge a patient's beliefs about the nature of pain generally, and what might be causing their pain specifically

It is not simply the addition of new information on top of the patient's existing belief system. We must actually de-educate the patient, and their faulty beliefs, before re-educating them

# 1. RE-FRAME MEANING OF PAIN

Research Paper

PAIN®

## What do patients value learning about pain? A mixed-methods survey on the relevance of target concepts after pain science education

Hayley B. Leake[a,b,*], G. Lorimer Moseley[a], Tasha R. Stanton[a], Edel T. O'Hagan[b,c], Lauren C. Heathcote[d]

**Abstract**

Pain education is a popular treatment approach for persistent pain that involves learning a variety of concepts about pain (ie, target concepts), which is thought to be an important part of recovery. Yet, little is known about what patients value learning about pain. A mixed-methods survey was conducted to identify pain concepts that were valued by people with persistent pain who improved after a pain science education intervention. An online survey was distributed to 123 people who were treated for persistent pain with a pain science education approach; responses of participants who self-identified as "improved" were analysed. Open-ended survey questions were analysed using reflexive thematic analysis and close-ended questions were analysed for frequency of responses. Each question-type was analysed separately, before integration for complementarity. We analysed the data of 97 participants. We constructed 3 themes from the open-ended questions. *Pain does not mean my body is damaged* (theme 1) captured the importance of abandoning preexisting ideas that pain indicated damage. *Thoughts, emotions and experiences affect pain* (theme 2) captured the value of recognising multifactorial influences on pain. *I can retrain my overprotective pain system* (theme 3) captured the importance of conceptualising pain as a heightened protective response that could be lessened. Responses from close-ended questions confirmed that the target concepts represented by these themes are among those most valued, although divergence with the qualitative data suggests differences between patient and clinician language. These data offer patient-centred conceptualizations and language that could assist in further refining pain education interventions.

**Keywords:** Pain education, Pain science, Patient perspective, Mixed-methods, Chronic pain

Pain does not always mean my body is damaged

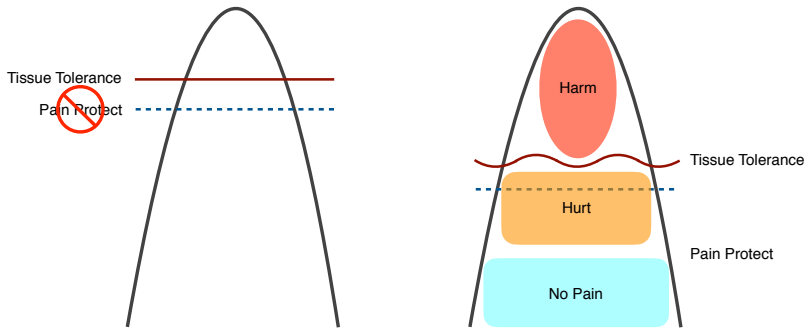
I can have a painful back that is still a strong back

Structures can be sensitive but not fragile

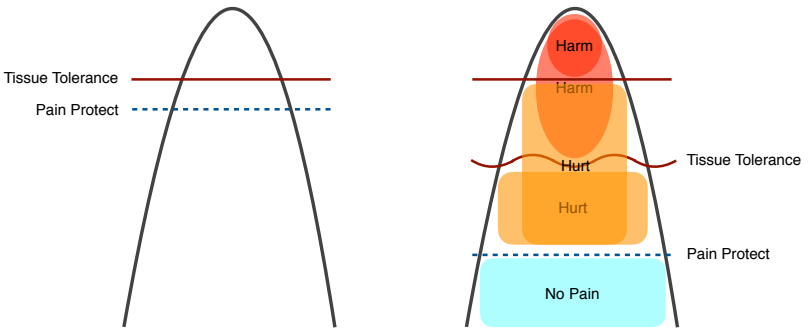
Whether sensory input translates to a pain experience is also dependent upon feelings, emotions and beliefs

I can retrain my overprotective pain system - the appropriate strength of the warning system can be reset

## EXPLAIN PAIN



# EXPLAIN PAIN




# 2. BLURRY BRAIN MAPS

# CONCEPTUAL CHANGE STRATEGY

The explanation given for treatment can influence the patient's response to the same manual treatment approach

JOURNAL OF MANUAL & MANIPULATIVE THERAPY, 2017
VOL. 25, NO. 5, 227–234
https://doi.org/10.1080/10669817.2016.1231860



## The effect of manual therapy and neuroplasticity education on chronic low back pain: a randomized clinical trial

Adriaan Louw[a], Kevin Farrell[b], Merrill Landers[c], Martin Barclay[b], Elise Goodman[b], Jordan Gillund[b], Sara McCaffrey[b] and Laura Timmerman[b]

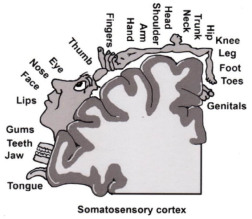
[a]International Spine and Pain Institute, Story City, IA, USA; [b]Department of Physical Therapy Education, Residency Program, St. Ambrose University, Davenport, IA, USA; [c]Department of Physical Therapy, School of Allied Health Sciences, University of Nevada, Las Vegas, NV, USA

**ABSTRACT**

**Objective**: To determine if a neuroplasticity educational explanation for a manual therapy technique will produce a different outcome compared to a traditional mechanical explanation.
**Methods**: Sixty-two patients with chronic low back pain (CLBP) were recruited for the study. Following consent, demographic data were obtained as well as pain ratings for low back pain (LBP) and leg pain (Numeric Pain Rating Scale), disability (Oswestry Disability Index), fear-avoidance (Fear-Avoidance-Beliefs Questionnaire), forward flexion (fingertips-to-floor), and straight leg raise (SLR) (inclinometer). Patients were then randomly allocated to receive one of two explanations (neuroplasticity or mechanical), a manual therapy technique to their lumbar spine, followed by post-intervention measurements of LBP, leg pain, forward flexion, and SLR.
**Results**: Sixty-two patients (female 35 [56.5%]), with a mean age of 60.1 years and mean duration of 9.26 years of CLBP participated in the study. There were no statistically significant interactions for LBP ($p = .325$), leg pain ($p = .172$), and trunk flexion ($p = .818$) between the groups, but SLR showed a significant difference in favor of the neuroplasticity explanation ($p = .041$). Additionally, 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.
**Discussion**: The results of this study show that a neuroplasticity explanation, compared to a traditional biomechanical explanation, resulted in a measureable difference in SLR in patients with CLBP when receiving manual therapy. Future studies need to explore if the increase in SLR correlated to changes in cortical maps of the low back.

**KEYWORDS**
Pain; brain; plasticity; education; manual therapy; straight leg raise; remapping

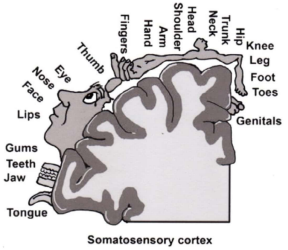
**Table 1.** Biomechanical and anatomical explanation of manual therapy.

| Neuroplasticity (EG) | Biomechanical (CG) |
|---|---|
| *Explanation*<br>• Have a look at this picture – it's a picture of a brain map of a human body<br>• In your brain there is a map telling you where your body parts are. For example, if we had you close your eyes and touch your nose with your right index finger, you'd have no problem doing it<br>• When life is good and we move during daily tasks, work, and exercise these maps are 'exercised' and they stay healthy – sharp and crisp – so we know where the body parts are<br>• When we have pain, move less and do less, the brain areas are not exercised and in essence become blurred<br>• Scientists have now shown us that this happens very fast and the more 'blurred' the area is, the more pain we have<br>• We can retrain the brain maps<br>• Today I am going to do some manual treatments to your back as a means to help your brain sharpen its maps | *Explanation*<br>• Here is a picture of your low back<br>• There are five bones in your lower back<br>• When life is good and we move, for example, bending forward, each level takes part in the movement and in essence shares the load<br>• When we develop back pain – some levels stiffen up due to swelling and muscle spasms as a means to protect you<br>• I am going to do some treatment on your back with my hands to loosen up your back with the aim to make each level move |
| *Picture*<br>  <br><br>**Somatosensory cortex** | *Picture*<br>  |
| *Words during the treatment*<br>• Let the patient know which level you're on (i.e. L5) and have them verbalize it<br>• When moving to another level, repeat the process | *Words during the treatment*<br>• No mention of what is found, but rather a 'general' stiffness and manual loosing up each level |

Neuroplasticity (EG)

*Explanation*

- Have a look at this picture – it's a picture of a brain map of a human body
- In your brain there is a map telling you where your body parts are. For example, if we had you close your eyes and touch your nose with your right index finger, you'd have no problem doing it
- When life is good and we move during daily tasks, work, and exercise these maps are 'exercised' and they stay healthy – sharp and crisp – so we know where the body parts are
- When we have pain, move less and do less, the brain areas are not exercised and in essence become blurred
- Scientists have now shown us that this happens very fast and the more 'blurred' the area is, the more pain we have
- We can retrain the brain maps
- Today I am going to do some manual treatments to your back as a means to help your brain sharpen its maps



**Somatosensory cortex**

*Words during the treatment*

- Let the patient know which level you're on (i.e. L5) and have them verbalize it
- When moving to another level, repeat the process

Biomechanical (CG)

*Explanation*

- Here is a picture of your low back
- There are five bones in your lower back
- When life is good and we move, for example, bending forward, each level takes part in the movement and in essence shares the load
- When we develop back pain – some levels stiffen up due to swelling and muscle spasms as a means to protect you
- I am going to do some treatment on your back with my hands to loosen up your back with the aim to make each level move

*Words during the treatment*

- No mention of what is found, but rather a 'general' stiffness and manual loosing up each level

# METAPHORS & ANALOGIES
# FAMILIAR REFERENCE FRAMES

The Method of Loci is a well known trick for remembering a list of items. It involves mentally placing and picturing items at some location in your house

To recall the list you simply imagine walking through your house, which brings back the memory of each item in succession

This supports the premise that information is stored in reference frames and retrieval of that information is a form of movement

This process is effective because it places new information within a familiar reference frame - the model of their house

## EXAMPLE STRATEGIES

## HARDWARE VS SOFTWARE

## MOTOR IMAGERY IS A WAY OF MENTALLY MOVING THROUGH CORTICAL MODELS FOR MOVEMENT

Motor imagery has been used successfully in patients with knee osteoarthritis, lower back pain, and following total knee replacement

*Pain Medicine*, 21(12), 2020, 3548–3555
doi: 10.1093/pm/pnaa103
Advance Access Publication Date: 28 April 2020
**Original Research Article**

OXFORD

**REHABILITATION & REGENERATIVE MEDICINE SECTION**

# Effects of Adding Motor Imagery to Early Physical Therapy in Patients with Knee Osteoarthritis who Had Received Total Knee Arthroplasty: A Randomized Clinical Trial

**María Briones-Cantero, PT,* César Fernández-de-las-Peñas, PT, PhD,[†,‡] Enrique Lluch-Girbés, PT, PhD,[§,¶] María C. Osuna-Pérez, PT, PhD,[‖] Marcos J. Navarro-Santana, PT,** Gustavo Plaza-Manzano, PT, PhD,[††,‡‡] and Patricia Martín-Casas, PT, PhD[††,‡‡]**

"MI is a type of movement representation technique where a patient mentally simulates a movement/action without real execution. Interestingly, MI leads to activation of the same neuronal networks as those activated by real movement, contributing to improvement of motor performance and learning of new motor skills. The underlying neural substrate of MI is the mirror neurons system, which is activated when imagining movements but also when observing others performing movement. The application of MI may allow patients to feel themselves performing the movement with no pain when movement is actually not possible or is difficult due to irritability or pain, thus resulting in positive outcomes."

ARTICLE IN PRESS

American Pain Society
RESEARCH
EDUCATION
TREATMENT
ADVOCACY

PUBLISHED BY
ELSEVIER

The Journal of Pain, Vol 00, No 00 (00), 2018: pp 1–14
*Available online at www.jpain.org and www.sciencedirect.com*

Original Reports

# Brain Mechanisms of Anticipated Painful Movements and Their Modulation by Manual Therapy in Chronic Low Back Pain

Dan-Mikael Ellingsen,* Vitaly Napadow,* Ekaterina Protsenko,*,† Ishtiaq Mawla,*,‡ Matthew H. Kowalski,§ David Swensen,¶ Deanna O'Dwyer-Swensen,¶ Robert R. Edwards,‖ Norman Kettner,** and Marco L. Loggia*

**A. A. Martinos Center for Biomedical Imaging, Department of Radiology, Massachusetts General Hospital, Harvard Medical School, Boston, Massachusetts, †School of Medicine, University of California, San Francisco, California, ‡Neuroscience Graduate Program, University of Michigan Medical School, Ann Arbor Michigan, §Osher Integrative Care Center, Brigham and Women's Hospital, Boston, MA, Massachusetts, ¶Melrose Family Chiropractic & Sports Injury Centre, Melrose, Massachusetts, ‖Department of Anesthesiology, Harvard Medical School, Brigham & Women's Hospital, Boston, Massachusetts, **Department of Radiology, Logan University, Chesterfield, Missouri*

Is there a way that we could further amplify the sensory remapping (cortical reorganising) effects of sensory input?

Disrupted cortical representation leads to reduced sensory acuity - a form of sensory neglect and movement imprecision

We could also view this as highlighting prediction errors to encourage the brain to update errors in models of body parts

The concept of 'sensory discrimination training' involves challenging the patient to discriminate between sensory inputs

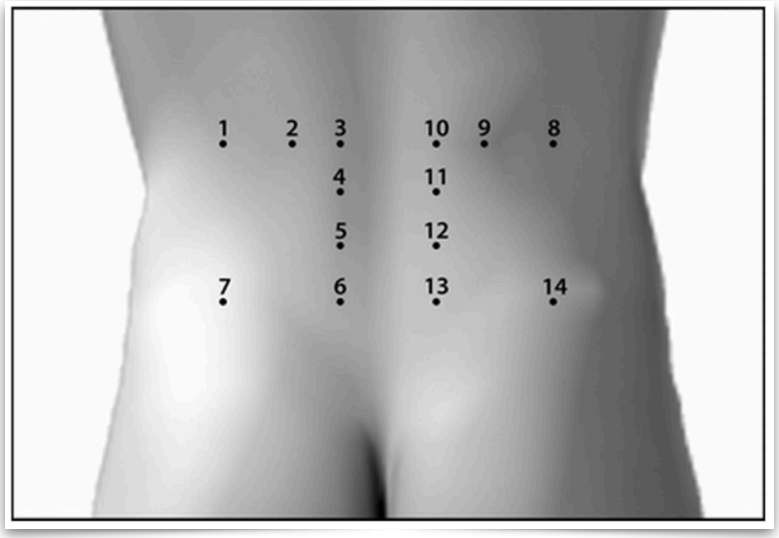
# HARNESSING THE POWER OF THE ATTENTIONAL SYSTEM



Original article

## Acupuncture applied as a sensory discrimination training tool decreases movement-related pain in patients with chronic low back pain more than acupuncture alone: a randomised cross-over experiment

Benedict Martin Wand,[1] Sam Abbaszadeh,[2] Anne Julia Smith,[3] Mark Jon Catley,[4] G Lorimer Moseley[4]

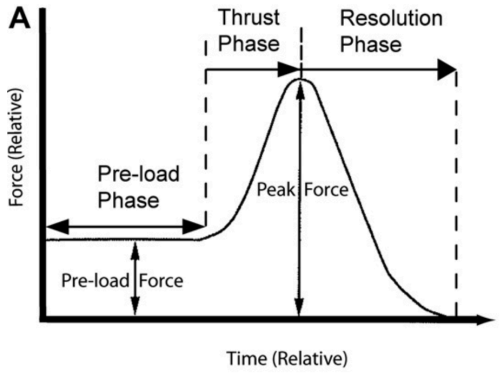


"Our findings are consistent with the idea that acupuncture may offer specific benefit that is not dependent on precisely where the needles are inserted so much as that the patient attends to where they are inserted."

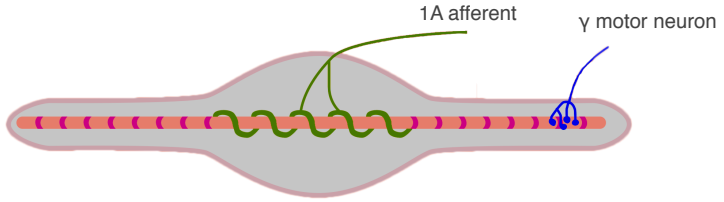
## REMAPPING WITH PHYSICAL INPUTS

How do we get therapeutic leverage upon the neck's sensory machinery but at the same time be very conservative with applying forces to its mechanical machinery?

# MECHANICAL SIGNATURE OF AN ADJUSTMENT IS THE FORCE-TIME PROFILE




# NEUROLOGICAL SIGNATURE OF AN ADJUSTMENT

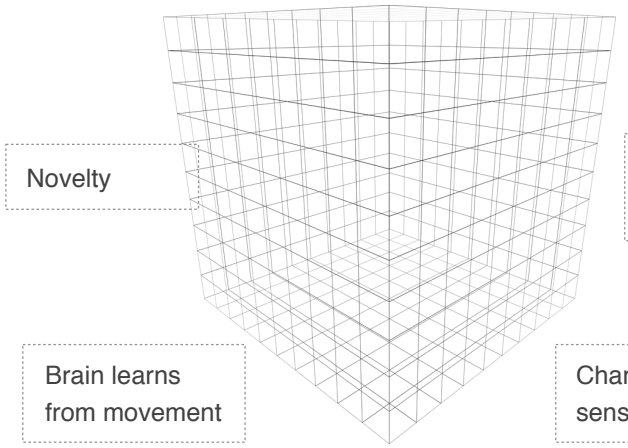


## SO WHAT IS AN ADJUSTMENT?

Neuromodulation

# INPUT

## MANAGEMENT FLEXIBILITY AND CREATIVITY



ORIGINAL ARTICLE

# Clinical Scenarios for Which Cervical Mobilization and Manipulation Are Considered by an Expert Panel to Be Appropriate (and Inappropriate) for Patients With Chronic Neck Pain

*Patricia M. Herman, ND, PhD,* Howard Vernon, DC, PhD,† Eric L. Hurwitz, DC, PhD,‡ Paul G. Shekelle, MD, PhD,* Margaret D. Whitley, MPH,* and Ian D. Coulter, PhD**

**Objectives:** Cervical mobilization and manipulation are 2 therapies commonly used for chronic neck pain (CNP). However, safety, especially of cervical manipulation, is controversial. This study identifies the clinical scenarios for which an expert panel rated cervical mobilization and manipulation as appropriate and inappropriate.

**Key Words:** chronic neck pain, appropriateness of care, RAND/UCLA appropriateness method, decision tree analysis, cervical mobilization and manipulation

(*Clin J Pain* 2020;36:273–280)

# MANIPULATION v. MOBILISATION

## PATHOANATOMICAL DECISION-MAKING

Stability of cervical spine

Vascular effects on nerve root

Mechanical insult to nerve root

IVF considerations

Vertebral artery considerations

Central canal considerations

Spinal cord considerations

## MATCH FORCES WITH MECHANICAL INTEGRITY

Forces generated during thrust manipulation differ based upon mechanics of the spinal spinal level

Taller uncinate processes in upper cervical spine (C2-3) control motion while the less robust lower cervical uncinate processes (C5-6-7) allow greater rotation to occur

Neuromodulation for pain may be achieved via treatment at more stable or remote sites. Thoracic manipulation is well supported in patients with neck pain and radiculopathy

Neuromodulation and improved motion for PNP can be achieved with manipulation applied to segments that typically demonstrate less disc degeneration, such as the more anatomically stable C2/3 and C7/T1 segments

## MINIMISE ROTATIONAL LEVERS WHEN LOWER CX INSTABILITY

Degenerative cervical segments are inherently unstable in rotation and translation

Remember that degenerative hypertrophy, foraminal narrowing, and near-universal instability is observed with CDD at the C4-C6 segments

Positioning lower cervical segments in mid-range (neutral to slight flexion) during manual interventions maximizes space for neural structures without stressing degenerative tissues.

## DECOMPRESSION & INCREASED FORAMINAL AREA

For patients with radicular symptoms due to foraminal closure, compression of radicular arteries, and nerve root oedema due to venous obstruction, light oscillatory traction forces may facilitate neuromodulation, fluid pumping effects and improved segmental motion without generating excessive shear, torsional, or bending stresses

For patients with end-stage degenerative change, management should focus on proprioceptive activation and decompression, not ROM restoration at the involved segments

## VERTEBRAL ARTERY

Osteophytes may compress the V2 segment of the Vertebral Artery, most commonly at the C3-5 segments.

Rotational levers/forces should be used with caution in the presence of facet joint arthritic hypertrophy and uncinate process spondylotic hypertrophy.

## GAZE STABILITY

Retrain cervico-ocular reflex control

## POSTURE AND MOVEMENT RETRAINING

Prescribe stabilization training to control shear

Movement re-education with cranial initiation to minimize excessive early motion at the C4-C6 segments

Habits versus exercises, micro-movement behaviour

## INTER-PROFESSIONAL COMMUNICATION

Pain as a protective behaviour

Cortical representation (model)

Balance, posture and sensorimotor control

Biomechanics and pathoanatomy

Red flags

## A SIMPLE GUIDE

Emphasise **diagnosis**, not treatment detail

Use common **clinical terminology**, no jargon

**Pathology**, not 'function'

1. Describe primary complaint
2. What it **isn't**
3. What it **is**
4. **Rationale** for manual approach

Mr Smith has suffered repeated bouts of right-sided neck and scapula pain over some years, typically presenting as a wry neck. In addition, he's been troubled by variable dizziness in the absence of any concerning associated symptoms. Mr Smith is reassuringly intact neurologically, with no signs of nerve root or spinal cord encroachment. His symptoms are well explained by mechanical pain generators within a de-conditioned cervical spine that now interact with sensitised central pain pathways. In the absence of vestibular or other pathological causes, variable dizziness is also commonly associated with chronic neck pain and spondylosis. Patients like Mr Smith tend to respond favourably to gentle manual treatment approaches aimed at improving cervical proprioception and restoring healthier neuromuscular control over available joint motion. A strong emphasis on education regarding reasons for pain maintenance and rehabilitative self-care strategies are also important determinants of a good clinical outcome. We've begun a brief trial of treatment and I will keep you up-to-date regarding his progress.