Does the Addition of Pain Neuroscience Education for Treatment of Neck Pain and Headaches Help? A Case Study

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Introduction: Neck pain is a common complaint by people of all ages, accounting for 30-50% of the population over a 12 month period.[1] Patient's with neck pain accounts for 25% of all patients seen in outpatient physical therapy.[2] A sizeable percentage will develop chronic neck pain or recurrence of symptoms, with 30% having neck pain that will last longer than 6 months.[3] Furthermore, 10% will develop functional impairments and 5% disabilities.[4] Neck pain and dysfunction account for a drastic loss in production to United States, with an estimated $19.6 billion lost from headaches alone.[5] It is only second to low back pain as a cause for loss of productivity at work.

Females are more likely to have neck pain and headaches.[2] Other risk factors include workplace stress, poor sleep quality, and high BMI in women as well as work related exhaustion in men. Chronic low back pain in addition to neck pain was also a predictor for chronic neck pain.[6] At initial evaluation, a thorough red flag and yellow flag screen is required to assess the appropriateness for treatment. Insidious Cervical Arterial Dysfunction (CAD) and cervical myelopathy are of noted importance during initial evaluation. CAD symptoms can mimic neck pain and headaches and present with abnormal neurological presentations.[7,8] Myelopathy symptoms include upper motor neuron signs, bowel or bladder dysfunction, multisegmental weakness and sensory changes, and gait ataxia.[7]

Current practice guidelines for the treatment of neck pain recommends the use of a classification system for patients with neck pain and headaches. Classifications are based on movement limitations of thoracic and cervical regions, presence of cervicogenic headaches, history of trauma, and referred or radiating pain into the upper extremity to assign patients to one of four catagories: Neck pain with mobility deficits, neck pain with movement coordination impairments, neck pain with headaches, and neck pain with radiating pain.[9] Specific interventions are recommended based on acuity and assigned classification, but should be applied on a patient by patient basis.

Pain Neuroscience Education (PNE) uses a biopsychosocial framework to help change beliefs to alter pain experiences and behavior. PNE has been shown to be effective in reducing pain, improving function, and lowering fear and catastrophizing is patients with chronic pain.[10,11,12] PNE attempts to limit the emphasis on tissue injury that is used in a biomedical model of pain. It has also shown to be effective in the promotion of physical movement, decreasing pain ratings, and improving knowledge of their individual pain experience.[13] Patients who are in pain, especially those in chronic pain, are often interested in learning more about the causes and mediators of their pain.[12] Those who are allowed to tell their own story about their pain experience also are able to better cope with their condition.[14] Despite the growing knowledge and foundation of evidence for its clinical application, PNE is not a staple of most physical therapist.

A key aspect of PNE is that it is not effective in isolation for the treatment of chronic pain. As a stand-alone treatment, it does not produce a clinically significant decrease in pain and disability.[14] Evidence has shown improved outcomes when PNE is combined with exercise. A recent systematic review by Siddall et al. found that combining PNE and exercises was superior for short term improvements in pain, disability, kinesiophobia, and pain catastrophizing relative

to exercise alone.[15] Another recent study compared exercise combined with education (PNE+) to usual treatment in primary care settings. The results of the study showed a clinically and statistically significant difference in favor of the combined exercise and education group.[16]

Additional research into the efficacy of PNE+ and therapeutic exercise concluded that it led to improved outcomes at the three-month mark with chronic low back pain.[17] Patients in this study had a significant reduction in pain rating scale, as well as secondary outcome measures including pain pressure threshold and self-reported outcome measures.

Manual therapy can be used in conjunction with PNE to assess the depth of central sensitization and abnormal pain responses.[18] Manual therapy builds therapeutic alliance, and emerging evidence suggests that it may improve pain outcomes for patients with chronic pain.[12,19] Ultimately, the quality of evidence for the use of manual therapy and PNE is moderate at best. There is a need for higher quality studies as the body of evidence for PNE+ application continues to grow.

The use of metaphors have been shown to improve the understanding and conceptualization of PNE. There is however no consensus on any one metaphor being superior to another.[10] A recent study by Leake et al. attempted to determine what themes seemed to be most important to patients when learning about pain. Three themes were determined to be most beneficial. Theme 1: “Pain does not mean my body is damaged”; Theme 2: “Thoughts, emotions, and experiences affect pain”; Theme 3: “I can retrain my overprotective pain system.”[20] These broader concepts can be transitioned into various metaphors to better grasp and reconceptualize patients pain experiences. Metaphors should be delivered in individual sessions vs the group. Change in pain at one-year following PNE was better for those who received one-on-one delievery.[21]

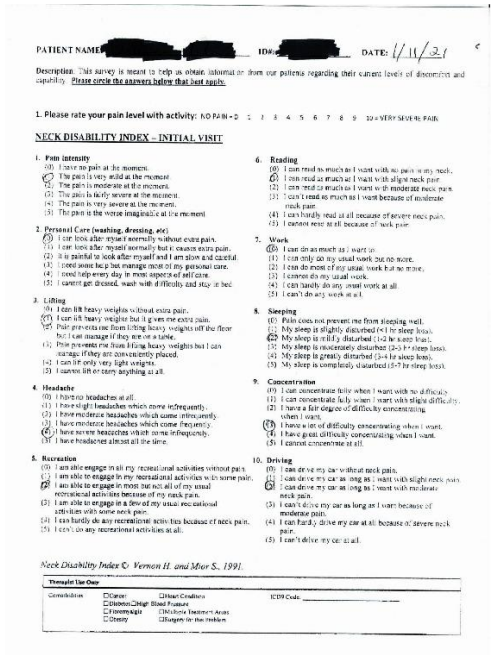
The purpose of this case study is to determine the efficacy of PNE in a patient with chronic neck pain and headaches, as well as reconceptualize the patients pain experience to eliminate fear avoidance behaviors and facilitate a return to exercise and recreational activities.

Timeline: This patient began physical therapy in January 2021. The patient attended physical therapy two times a week for a period of eight weeks. Plan of care consisted of a total of 16 visits including initial evaluation and discharge.

Patient Demographics: Patient is a 31 year old female. Patient is 60 inches tall and 109 lbs. Significant past medical history includes a diagnosis of occipital neuralgia following a facial shingles infection in 2016. Red flags at initial evaluation included presence of facial and tongue numbness with severe migraines. Yellow flags also present with significant fear avoidance behaviors, recent increase in psychosocial stress related to job change. History of the current symptoms of headaches/migraines and neck pain since initial shingles infection in 2016. Patient reports no relief or improvement from other health care providers which includes neurologist, cardiologist, chiropractic, and naturopathic medicine. MRI and radiograph imaging in 2017 were unremarkable. The patient reports that symptoms are poorly managed at this time with medication for migraines. Prior to symptom onset, patient was a yoga instructor and participated

in HIIT training three times per week, both of which have been avoided due to previously highlighted yellow flags.

Information: Patient was referred to physical therapy from PCP for chronic neck pain and migraines. The patient reports constant posterior cervical pain that progressively worsens through the day. Pain at its best is 2/10 and worst pain is 7/10 with current pain at initial evaluation at a 3/10. Aggravating factors include prolonged sitting > 15 minutes, driving, work related stress, and yoga poses that involve cervical extension. Pain is eased back to best 2/10 with heating pad or ice prior to sleeping. Patient reports that pain is worse in PM, but AM pain can be elevated with poor sleep quality. Patient also reports headaches and migraines that occur with elevation of cervical pain intensity. Pain is reported 0/10 at best, and 10/10 at worst with no current pain. Aggravating factors are same as cervical pain and described as directly correlated. Headaches and migraines are eased with light and sound removal, medication, and sleep. Headaches occur 2-3 times per week. There is no reported 24-hour symptoms. Additionally, patient reports bilateral upper trapezius pain and parascapular pain. Pain is described as a constant tightness in musculature. Pain reported at 0/10 best and 5/10 worst. Current pain is a 2/10. Aggravating factors include lifting greater than 5 lbs., long hold yoga poses, and prolonged sitting of more than 15 minutes. Lifting and yoga holds reproduce symptoms immediately. Patient reports minimal to moderate success with stretching to relieve these symptoms. Primary outcome measure was the patient's ability to participate in yoga and HIIT workouts. Other outcome measures included the Neck Disability Index (NDI) and visual analog pain scale (VAS). NDI is a self-reported outcome measure and the most common outcome for patients with neck and upper thoracic pain or dysfunction. NDI was assessed in the case at the initial evaluation, the 10th visit, and at discharge to assess self-reported functional change throughout the plan of care.



PATIENT NAME [redacted] ID# [redacted] DATE: 1/11/21

Description: This survey is meant to help us obtain information from our patients regarding their current levels of discomfort and capability. Please circle the answers below that best apply.

1. Please rate your pain level with activity: NO PAIN = 0 1 2 3 4 5 6 7 8 9 10 = VERY SEVERE PAIN

NECK DISABILITY INDEX – INITIAL VISIT

1. Pain intensity
(0) I have no pain at the moment.
(1) The pain is very mild at the moment.
(2) The pain is moderate at the moment.
(3) The pain is fairly severe at the moment.
(4) The pain is very severe at the moment.
(5) The pain is the worst imaginable at the moment

2. Personal Care (washing, dressing, etc)
(0) I can look after myself normally without extra pain.
(1) I can look after myself normally but it causes extra pain.
(2) It is painful to look after myself and I am slow and careful.
(3) I need some help but manage most of my personal care.
(4) I need help every day in most aspects of self care.
(5) I cannot get dressed, wash with difficulty and stay in bed

3. Lifting
(0) I can lift heavy weights without extra pain.
(1) I can lift heavy weights but it gives me extra pain.
(2) Pain prevents me from lifting heavy weights off the floor, but I can manage if they are on a table.
(3) Pain prevents me from lifting heavy weights but I can manage if they are conveniently placed.
(4) I can lift only very light weights.
(5) I cannot lift or carry anything at all.

4. Headache
(0) I have no headaches at all.
(1) I have slight headaches which come infrequently.
(2) I have moderate headaches which come infrequently.
(3) I have moderate headaches which come frequently.
(4) I have severe headaches which come infrequently.
(5) I have headaches almost all the time.

5. Recreation
(0) I am able engage in all my recreational activities without pain
(1) I am able to engage in my recreational activities with some pain.
(2) I am able to engage in most but not all of my usual recreational activities because of my neck pain.
(3) I am able to engage in a few of my usual recreational activities with some neck pain.
(4) I can hardly do any recreational activities because of neck pain.
(5) I can't do any recreational activities at all.

6. Reading
(0) I can read as much as I want with no pain in my neck.
(1) I can read as much as I want with slight neck pain.
(2) I can read as much as I want with moderate neck pain.
(3) I can't read as much as I want because of moderate neck pain.
(4) I can hardly read at all because of severe neck pain.
(5) I cannot read at all because of neck pain

7. Work
(0) I can do as much as I want to.
(1) I can only do my usual work but no more.
(2) I can do most of my usual work but no more.
(3) I cannot do my usual work.
(4) I can barely do any usual work at all.
(5) I can't do any work at all.

8. Sleeping
(0) Pain does not prevent me from sleeping well.
(1) My sleep is slightly disturbed (<1 hr sleep loss).
(2) My sleep is mildly disturbed (1-2 hr sleep loss).
(3) My sleep is moderately disturbed (2-3 hr sleep loss).
(4) My sleep is greatly disturbed (3-4 hr sleep loss).
(5) My sleep is completely disturbed (5-7 hr sleep loss).

9. Concentration
(0) I can concentrate fully when I want with no difficulty
(1) I can concentrate fully when I want with slight difficulty.
(2) I have a fair degree of difficulty concentrating when I want.
(3) I have a lot of difficulty concentrating when I want.
(4) I have great difficulty concentrating when I want.
(5) I cannot concentrate at all.

10. Driving
(0) I can drive my car without neck pain.
(1) I can drive my car as long as I want with slight neck pain.
(2) I can drive my car as long as I want with moderate neck pain.
(3) I can't drive my car as long as I want because of moderate pain.
(4) I can hardly drive my car at all because of severe neck pain.
(5) I can't drive my car at all.

Neck Disability Index © Vernon H. and Mior S., 1991.

Therapist Use Only

Comorbidities: ☐Cancer ☐Diabetes ☐High Blood Pressure ☐Fibromyalgia ☐Obesity ☐Heart Condition ☐Arthritis ☐Surgery in the Problem Area

ICD9 Code: _____

Figure 1 NDI Initial Evaluation.

Physical Exam: Objective measures obtained during the physical exam included postural and functional movement assessment, active and passive ROM, joint mobility, and several special tests for the cervical spine. The patient's pain at beginning of physical exam is reported at 3/10. The patient's posture demonstrated rounded shoulders with bilateral upper extremity internal rotation. A neurological screen was normal for upper quarter dermatomes and myotomes. Eye movements screening also normal and not provocative. UMN, VBI, and Upper cervical instability tests all normal making patient appropriate for further objective testing. Thoracic ROM was assessed in sitting with hypermobility in all planes despite reporting subjective "stiffness" during AROM. Cervical ROM performed in sitting with limitations in flexion (45*) and extension (45*). Cervical extension was positive for chief complaint of neck pain. Patient was tender to palpation of thoracic and cervical paraspinals, levator scapulae upper trapezius, and SCM bilaterally. Upper and lower cervical joint mobility assessment was performed in prone and positive for familiar neck pain with CPAs and UPAs at C3-7. Thoracic joint mobility assessment was positive T1-8 for upper trap and parascapular pain. The patient reported an "ache behind her eyes" with C0-1, C2/3, and C1-2 unilateral PA's. Suboccipital palpation was performed in supine and positive for headache symptoms. The patient pointed to temporal region bilaterally and pain elevated to 7/10 with immediate return to baseline following palpation. A deep neck flexor endurance test was performed in supine and SCM compensation occurred at 10 seconds. Functional examination included OH lifting and yoga poses (downward dog, warrior 1 & 2, and chaturanga). All functional exam positions were positive for familiar neck pain and parascapular pain.

Interventions: Treatment at initial evaluation included manual suboccipital release, supine deep neck flexor (DNF) strengthening, and snow angels on a foam roller. Manual suboccipital release (SOR) was performed x 2 with reproduction of neck and headaches symptoms. Neck pain reduced in intensity in 90 seconds, with headache resolved in two minutes. Headaches were not reproduced during second SOR. DNF strengthening and snow angels on foam roll were demonstrated and required verbal and tactile cueing for proper completion. Both were given as home exercise program (HEP) following instruction. Follow up treatment interventions included manual therapy and exercises directed at postural re- education. The patient received SOR, upper cervical mobilizations grade III-IV, followed by prone lower and middle trap exercises and DNF endurance holds.

Tables (Table 1-3) show progression of manual therapy and exercise interventions that were provided throughout the plan of care. Manual therapy interventions were gradually decreased in favor of strengthening and mobility exercises as the patient progressed in the plan of care. Strengthening and mobility were progressed to functional patient specific tasks that included dynamic stability and mobility in open kinetic chain (OKC) and closed kinetic chain (CKC) positions.

Visit # (excluding evaluation & discharge)	Visit 2	Visit 3	Visit 4	Visit 5
Manual Therapy	CPA grade III-IV C3-7 Soft tissue mobilization (STM) posterior cervical musculature Manual Suboccipital release	CPA grade III/IV C3-7 Bilateral UPA grade III/IV T1-8 Suboccipital release	CPA grade III/IV C3-7 UPA grade II/III C0-1, 1-2 Bilateral UPA grade III/IV T1-8 Suboccipital release	CPA grade III/IV C3-7 UPA grade II/III C0-1, 1-2 Bilateral UPA grade III/IV T1-8 Suboccipital release
Exercise	Cervical ROM Thoracic ROM: rotation, extension Prone I, T, Y T-band Rows DNF endurance in supine	Cervical ROM Thoracic ROM: rotation, extension Parascapular strength: I,T,Y; rows, pulldowns, pushups plus DNF endurance in supine	Cervical ROM Thoracic ROM: rotation, extension Parascapular strength: I,T,Y; rows, pulldowns, pushups plus DNF endurance in supine	Cervical ROM Thoracic ROM: rotation, extension Parascapular strength: I,T,Y; rows, pulldowns, pushups plus DNF endurance in standing

Table 1. Manual therapy and exercises visit 2-5.

Visit 6	Visit 7	Visit 8	Visit 9	Visit 10
CPA grade III/IV C3-7 UPA grade II/III C0-1, 1-2 Bilateral UPA grade III/IV T1-8 Suboccipital release	UPA grade II/III C0-1, 1-2 Bilateral UPA grade III/IV T1-8 Suboccipital release	UPA grade II/III C0-1, 1-2 Bilateral UPA grade III/IV T1-8 Suboccipital release	Bilateral UPA grade III/IV T1-8 Suboccipital release	Bilateral UPA grade III/IV T1-8 Suboccipital release
Cervical ROM Thoracic ROM: rotation, extension Pec series Parascapular strength: I,T,Y; rows, pulldowns, pushups plus DNF endurance in standing Yoga	Parascapular strength: I,T,Y; rows, pulldowns, pushups plus Pec series DNF endurance in standing Bear crawl Inchworm Bird dogs Yoga	Parascapular strength: I,T,Y; rows, pulldowns, pushups plus Pec series DNF endurance in standing Bear crawl Inchworm Bird dogs Yoga	Parascapular strength: I,T,Y; rows, pulldowns, pushups plus, wall angels Pec series DNF endurance in standing Bear crawl Inchworm Bird dogs Yoga	Parascapular strength: I,T,Y; rows, pulldowns, pushups plus, wall angels Pec series DNF endurance in standing Bear crawl Inchworm Bird dogs Yoga
PNE: Baseline knowledge	PNE: Sensitive Nerves	PNE: Nerve Sensors	PNE: Pain and the brain	PNE: Emotions and pain

Table 2. Manual therapy exercises, and PNE visits 6-10.

Visit 11	Visit 12	Visit 13	Visit 14	Visit 15
Bilateral UPA grade III/IV T1-8 Suboccipital release	Suboccipital release	No Manual	No Manual	No manual
Parascapular strength: I,T,Y; rows, pulldowns, pushups plus, wall angels Pec series DNF endurance in standing Bear crawl Inchworm Bird dogs Yoga	Parascapular strength: I,T,Y; rows, pulldowns, pushups plus, wall angels Pec series Bear crawl Inchworm Bird dogs Yoga OH press Serratus sliders	Parascapular strength: I,T,Y; rows, pulldowns, pushups plus, wall angels Pec series Bear crawl Inchworm Bird dogs Yoga OH press Serratus sliders	Parascapular strength: I,T,Y; rows, pulldowns, pushups plus, wall angels Pec series Bear crawl Inchworm Bird dogs Yoga OH press Serratus sliders	Yoga HIIT workout modifications
PNE: Noisy neighbors	PNE: Lion and stress	PNE: Coping strategies	PNE: Fear avoidance cycle	PNE: miscellaneous

Table 3. Manual therapy, exercises, and PNE visits 11-15.

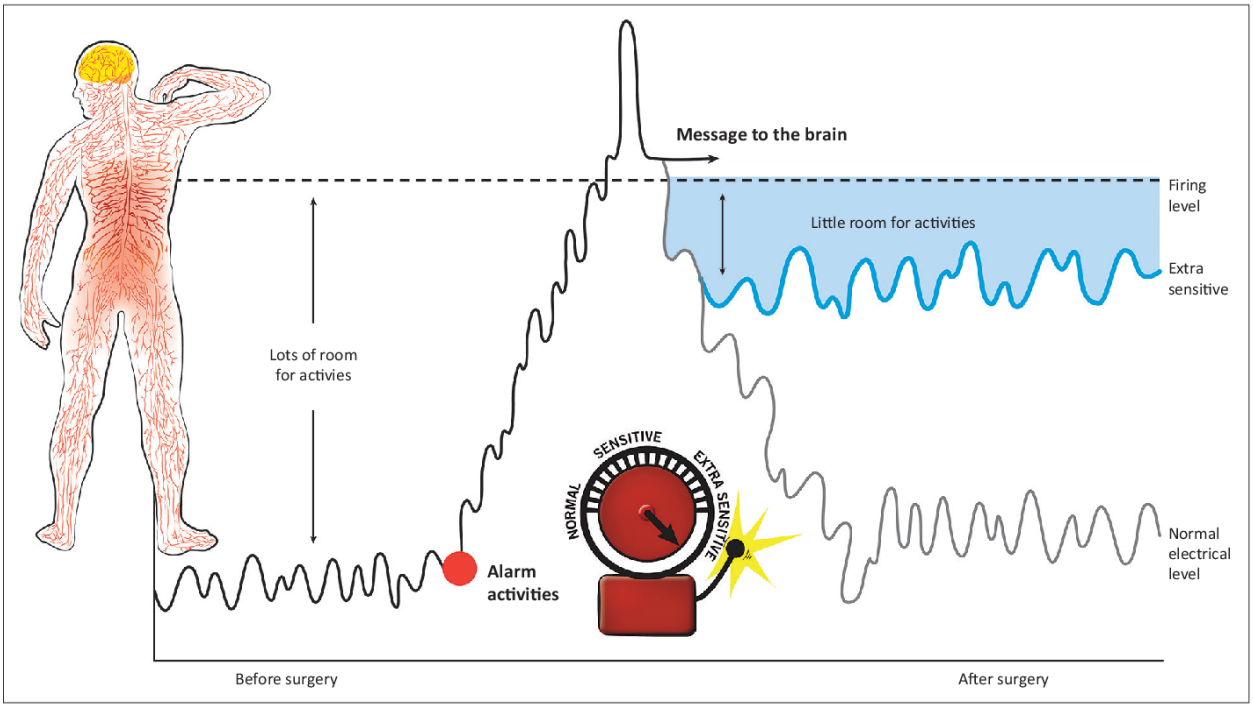
The patient was introduced to pain neuroscience education (PNE) at visit 6. Patient was given a Revised Neurophysiology of Pain Questionnaire (rNPQ) to obtain baseline knowledge of the patients understanding of pain science (Figure 2). Answers were discussed and initial PNE education followed. Metaphors and pictures were used from *Pain Neuroscience Education: Teaching Patients about Pain.* Figures 3 and 4 provided as examples but not specifically used in this case.

Revised Neurophysiology of Pain Questionnaire		T	F	U
1	It is possible to have pain and not know about it.			
2	When part of your body is injured, special pain receptors convey the pain message to your brain.			
3	Pain only occurs when you are injured or at risk of being injured.			
4	When you are injured, special receptors convey the danger message to your spinal cord.			
5	Special nerves in your spinal cord convey 'danger' messages to your brain.			
6	Nerves adapt by increasing their resting level of excitement.			
7	Chronic pain means that an injury hasn't healed properly.			
8	The body tells the brain when it is in pain.			
9	Nerves adapt by making ion channels stay open longer.			
10	Descending neurons are always inhibitory.			
11	Pain occurs whenever you are injured.			
12	When you injure yourself, the environment that you are in will not affect the amount of pain you experience, as long as the injury is exactly the same.			
13	The brain decides when you will experience pain.			

Figure 2. Example rNPQ

Story	Metaphor	Target topic
1	Alarm system: Your nerves working like an alarm system to protect you	Neurons, synapses, action potential and nociception
2	Extra-sensitive alarm: The nerves (alarm system) in your back becoming extra sensitive	Peripheral sensitisation, neuropathic pain, central sensitisation and hyperalgesia
3	Nerve sensors: Nerve sensors telling you about movement, stress and cold	Ion channel expression, peripheral sensitisation, neuroplasticity and hyperalgesia
4	Yellow flags: Issues (yellow flags) that keep your alarm system extra sensitive	Biopsychosocial risk factors, fear avoidance and pain catastrophisation
5	Nosy neighbours: Why nerves can become sensitive and how spreading pain might occur	Neuroplasticity, hyperalgesia, peripheral sensitisation and immune responses
6	Hospital experiences: Surgery and hospital experiences ramping up the alarm system	Fear avoidance, pain catastrophisation and stress biology
7	Calming sensitive nerves: Calming down the alarm system – knowledge and movement	Cognitive therapy, inhibition, endogenous mechanisms of pain control, aerobic exercise, desensitisation and addressing fear
8	Hurt does not equal harm: Understanding 'hurt does not equal harm' and 'sore but safe' sayings about extra-sensitive nerves	Peripheral and central sensitisation, fear avoidance, coping strategies, behaviour change, goal setting, pacing and graded exposure
9	Dry and wet brain: The brain's pain medicine	Endogenous mechanisms of pain control, neurotransmitters, inhibition and facilitation
10	No freaking over flare-ups: The ups and downs of normal recovery	Pacing, graded exposure, hyperalgesia, goal setting and internal locus of control
11	Pain is normal: Pain after surgery is to be expected and normal	Realistic goals, pain biologically normal, sensitisation and neuroplasticity

Figure 3. Example metaphors and target topics.[10]



Source: Louw, A., 2012, *Your nerves are having back surgery*, OPTP, Minneapolis, MN

Figure 4. Example picture used for alarm system metaphor.[10]

Outcomes: The patient achieved acute improvements for 24 hours following treatment sessions. Despite short term improvement in neck pain and headaches, symptoms would return to baseline prior to next session. Headaches also remained severe 1-2 times per week at visit six with no change in best pain rating of 2/10.

During week three, PNE+ was integrated into treatment sessions, spending 5-15 minutes with PNE per visit. PNE included: review of homework from previous session, answering questions related to previous metaphors, and new topic education and discussion (Table 2-3 & Figure 2). PNE would be followed by manual therapy and exercises.

At visit 10, the patient reported absence of headaches for previous 10 days. Current neck pain was 0/10 with little to no provocation of symptoms in the last week. NDI score improved from 32% to 4%. The patient reported participating in HIIT workout class one time per week as well as yoga practice one time per week, both with modifications to avoid aggravating factors.

Patient was discharged following visit 16. NDI score reported at 0% and no headache or neck pain symptoms for two weeks. The patient reported she continued to have upper trap and parascapular pain, but was able to relate it to HIIT workouts. At time of discharge, the patient was able to participate in HIIT classes two times per week and yoga daily without modifications. She was provided comprehensive HEP for continued strengthening of postural stabilizers following completion of plan of care.

Discussion: While PNE research has gained significant attention over the last several years, its implementation into clinical practice remains inconsistent. This case study demonstrates that while manual therapy and therapeutic exercise can improve outcomes in patients with chronic neck pain, the addition of PNE can directly influence a patient's ability to independently take control of their chronic pain. Several PNE concepts were strongly grasped in this case. First, the identification of the patient's yellow flags allowed for an updated understanding of chronic pain and not associate pain with tissue injury. Second, the understanding that pain is an output of the brain. Third, understanding central sensitization and how it relates to widespread and chronic pain. Lastly, graded exposure to subjective "harmful" activities allowing the patient to return to previously aggravating activities. As a result, the addition of PNE to the POC at visit six helped this patient to eliminate fear avoidance behaviors and return to the level of function prior to her initial symptom presentation three years prior.

While this was a successful case, a significant amount of therapeutic alliance and patient rapport was built prior to the introduction of PNE. Excellent therapeutic alliance and patient buy in are likely needed to create meaningful change with to PNE. Without these prerequisites, implementation into the plan of care would be difficult and possibly counterproductive to long term results. Furthermore, despite our best intentions as physical therapists, not all patients have positive expectations in regards to physical therapy and we must consider contextual factors as well when determining if PNE is appropriate.

Limitations: Limitations of this case study include absence of a validated yellow flag outcome measure such as the OSPRO-YF. This would allow us to show objective change in fear avoidance behaviors and yellow flags vs patient reported information. Another limitation to this was the delivery of PNE to the patient. There is currently no protocol for pain education but several methods on delivery. Another limitation in this study was the current practice guidelines for physical therapists in the state of Washington. PTWA limits the use of thrust manipulations for therapists. A manipulation endorsement must be secured to perform manipulations. The treating physical therapist in the case study was not endorsed and therefore manipulations unable to be incorporated into the plan of care despite good evidence for the use of thrust manipulations to the cervical and thoracic region. Lastly, patient had started an elimination diet a few weeks prior to beginning physical therapy. It is difficult to know if nutritional changes affected the patient's response to interventions provided throughout the plan of care. Overall the addition of the OSPRO-YF would have greatly improved the quality of data and ability to see objective meaningful change.

Figure 5 Thoracic Rotation.

Figure 6 Thoracic Extension.

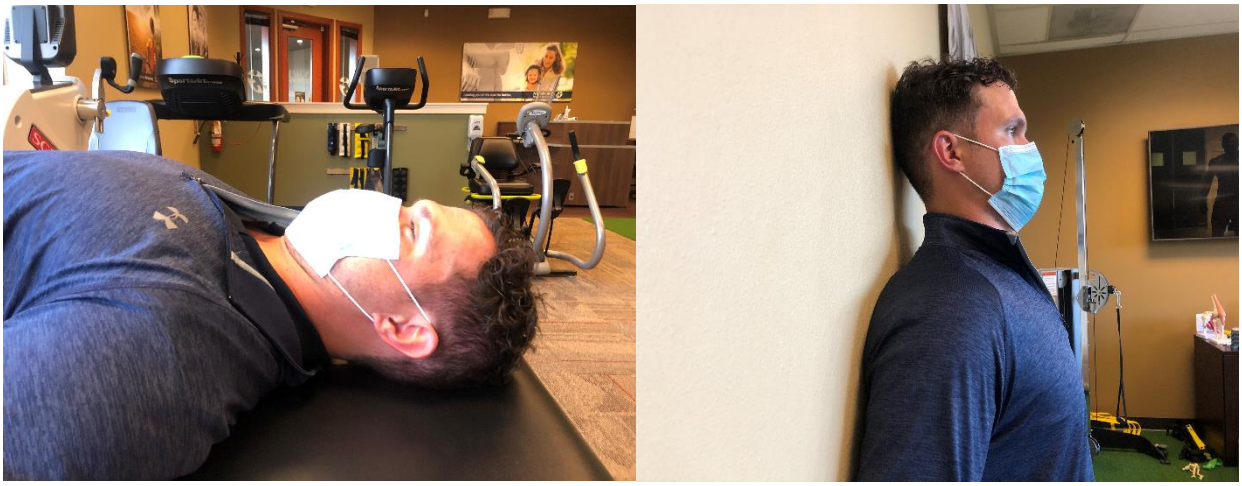


Figure 7 Supine & standing DNF.

Figure 8 T-band Row.

Figure 9-11 Prone I, T, Y.

Figure 12 Serratus Pushup.

Figure 13 Pec series.

Figure 14 Bear Crawl.

Figure 15 Birddogs.

Figure 16 Inchworms.

Figure 17 Chatarunga to up dog.

Figure 18 Warrior 1.

Figure 19 Warrior 2.

Figure 20 Cervical central posterior to anterior mobilization.

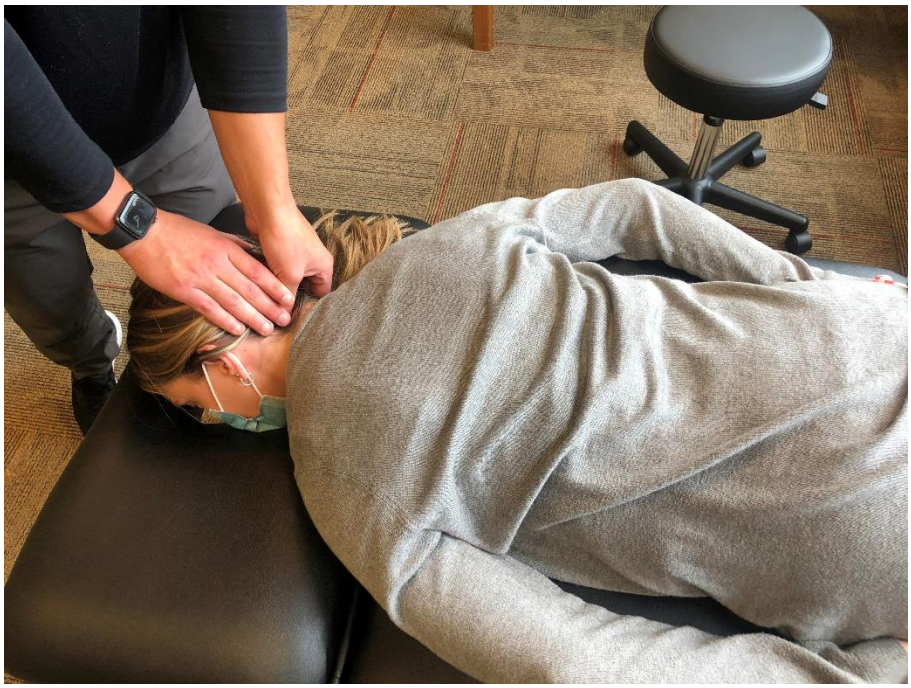


Figure 2110 Upper cervical unilateral posterior to anterior mobilization.

Figure 22 Thoracic bilateral UPA posterior to anterior mobilization.

Figure 23 Manual suboccipital release.

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