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Research Paper Review

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Review Title: Exercise Therapy for Chronic Musculoskeletal Pain: Innovation by Altering Pain Memories +MP3

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Study Title:
Exercise Therapy for Chronic Musculoskeletal Pain: Innovation by Altering Pain Memories

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Background Information:
Central nervous system (CNS) hyperexcitability, otherwise known as central sensitization, is a common feature in a number of chronic musculoskeletal (MSK) conditions. In some patients, even though the original nociceptive pathology has long-since resolved, they are left with a protective, movement-related 'pain memory' that can hamper their desire, and even their capacity, to move and exercise (or even return to normal activities, work etc.).

It has been proposed in several studies that exercise therapy can potentially decrease the sensitivity of the nervous system (1-5). Unfortunately, while these claims are great in theory, exercise therapy has not been explicitly shown to decrease pain in larger clinical trials. This narrative review describes how clinicians might combine pain neuroscience education (6, 7) with exercise/motor control training to alter the 'pain memories' associated with chronic pain.

Summary:
Imagine receiving a referral letter from a local physician, asking for your consultation on a female patient with sacroiliac joint and posterior leg pain. They have undergone many unsuccessful attempts at physical rehabilitation and manual therapy. The patient arrives and they describe being rear-ended at high speed one year ago. They anticipated the impact and braced themselves, but unfortunately the collision was bad enough to write the car off. Immediately post-accident, she developed dizziness, neck pain, lumbosacral pain,

groin pain and left posterior leg pain. She also reports diffuse parasthesiae throughout the low back and left leg. The leg pain and parasthesiae progressed over the year to encompass the entire leg and foot. This patient is not working, and is getting by on disability. Their brain, cervical spine, lumbar spine and hip MRI's are unremarkable, and only demonstrate mild diffuse degenerative changes.

They have a flat affect, and their pain is rated 10/10. Your examination reveals difficulty flexing forward due to lumbosacral and left posterior leg pain. The patient then refuses to complete the rest of the ROM examination, because she anticipates aggravating her already tremendous level of pain. Deep tendon reflexes are 2+ bilaterally in the upper and lower extremities. Cerebellar testing is normal. Pathological reflexes are absent. Your sensory examination reveals diffuse hypo-sensitivity to pinprick, soft touch, vibration and cold, with diffuse hyper-sensitivity to moderate deep palpation throughout the left leg. This patient is likely depressed and kinesiophobic, which magnify pain and limit activity. The sensory abnormalities described likely come from central sensitization, cortical smudging (14) and from the brain trying to decrease pain by decreasing sensory perception in the affected area (known as non-dermatomal sensory deficit or NDSD). This patient is a prime candidate for cognition-targeted exercise therapy, which will be discussed below.

Step 1: Preparations to provide cognition-targeted exercise therapy:

Clinicians must first intimately understand pain mechanisms, and how long-term nociception can lead to dysfunctional central processing (8, 9). Building on this foundation, one should then learn the evidence-based mechanisms behind central sensitization as it relates to chronic MSK pain (10). Additionally, clinicians are encouraged to understand the influence of kinesiophobia (fear of movement – more on this below), and how this is involved in the development of chronic pain. The patient should then be educated in pain science concepts to challenge, and hopefully change their beliefs about why they suffer from chronic pain.

It is also necessary for clinicians to be educated in various biopsychosocial therapies, such as graded activity, graded exposure and acceptance-based interventions. The clinician can then utilize these methods to build a graduated rehabilitation program to improve neuromuscular control (11-13) and combat kinesiophobia.

The centrally sensitized brain often demonstrates heightened activity in various brain structures, namely the insula, anterior cingulate cortex, prefrontal cortex, various brain stem nuclei, dorsolateral frontal cortex, parietal associated cortex and amygdala. For simplicity's sake, this network of brain areas is known as the neuromatrix. Hyperactivity is thought to be facilitated by long-term potentiation of neuronal synapses from ongoing nociception, and decreased GABA neurotransmission.

The amygdala is particularly important, as it has a cardinal role in sensitizing CNS pathways and preserving memories of painful movements, creating what are referred to as 'pain memories'. Interestingly, even when nociception has subsided, the chronic pain patient's brain continues to demonstrate these protective pain memories, which are manifested physically through pain behaviours such as antalgic postures and movements, altered motor control and/or kinesiophobia.

Patient's often become kinesiophobic, particularly to activities or movements that were initially painful during the acute/subacute injury phases. While it might be necessary to avoid these activities early on, it is likely that these actions are perfectly safe to perform in a chronic pain state. In spite of this, kinesiophobia often persists because the brain potentiates an association between movement and danger, creating pain memories. In these cases, appropriately regressing, and slowly exposing patients to (what the patient may consider) 'dangerous' movements is necessary.

Step 2: Cognition-targeted exercise therapy for chronic MSK pain:

Cognition-targeted rehabilitation aims to reconceptualise pain associated with exercise and movement, rather than training the individual to simply avoid pain. Essentially, the effort is to change the pain memory.

Goal setting should be a central component of an exercise program. The acronym *SMART (Specific, Measurable, Achievable, Realistic, Time-targeted)* should be used for goal setting. Generally, goals are set by the patient, with the guidance and assistance of the clinician.

During exercise sessions, the clinician must attempt to de-threaten 'dangerous' activities. Exercise selection and progression is based upon what the patient describes as painful or fearful. (14) *(Writer's aside: for instance, if the chronic pain patient finds forward spinal flexion painful/threatening, the movement can be regressed to side-lying spinal flexion with bent knees. Performing the movement without the influence of gravity may decrease the patient's perception of threat associated with spinal flexion. With time, the exposure to spinal flexion could be progressed to side-lying flexion with the knees straight, quadruped spinal flexion, and finally to standing, etc.)*. The therapist should identify if the patient feels any irrational fear or threat from exercise. If fear does exist, the clinician must identify why the patient feels threatened, and what they feel will happen if they do perform the exercise. The patient's reasoning and fear should then be challenged, by reminding them that chronic pain quality and intensity are not based upon the amount of structural damage, but rather on CNS hypersensitivity. In some cases, further exercise regression will be required.

Clinicians are cautioned against using language that can perpetuate threat, such as 'improving stability' – this language might make patients feel frail, and feel they require additional safety measures. Once mastered, the patient can be exposed to these movements during times of heightened psychosocial and cognitive stress, such as in the workplace, or social environments (14). A compliment to this type of exercise is motor control training, which has been investigated in great detail by other groups (11-13).

Clinical Application & Conclusions:

The goal behind cognition-targeted exercise therapy is to systematically desensitize painful movement and activity. This is achieved through repeated, graded exposure to 'dangerous' activities/movements to replace maladaptive pain memories with newer, safer ones. To accomplish this, the clinician should first enhance their knowledge of pain science, and teach the patient the neurophysiological mechanisms behind ongoing pain. Specifically, the patient should understand that chronic pain is often mediated by

heightened excitability and efficiency of CNS synaptic communication, or central sensitization. Knowledge is power!

Once the patient has a thorough understanding of these concepts, they can be progressively exposed to threatening movements and improve motor control. The hope is that the combination of pain science education, enhancing motor control and graded exposure will desensitize the patient to ongoing pain.

Study Methods:

This was a narrative review. No statistical measures were taken, nor pertinent study methods described.

Study Strengths / Weaknesses:

Strengths:

1. The article is incredibly well referenced. This will provide the reader with a map into the chronic pain management rabbit hole, should they desire.

Weaknesses:

1. The authors did not include enough examples for the reader who may be unfamiliar with some of these concepts.
2. The authors also did not allude to any studies statistically proving any of their claims. We are simply to accept their narrative without any empirical, high-level evidence to use as a backdrop.
3. The authors did not discuss how this model of care fits into standard medical care.

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