

Evidence of Pain Neuroscience Education on Musculoskeletal Disorders: An Updated Review

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ABSTRACT

Pain neuroscience education (PNE) is a new concept which helps the patients to modulate their pain perception and experiences. The concept has shown effectiveness, comparable to other pain-relieving modalities including manual therapies. The objective of the current review is to explore the mechanism on which pain neurosciences work and various methodologies to implement pain neuroscience education. The current literature of pain neurosciences education has been reviewed and the evidences synthesised to explore the above objectives. Pain neuroscience education takes into account the complexity of a pain experience and aids patients in redefining pain by educating them on the various neurophysiological, neurobiological, social, and physical factors that may be present in their particular pain experience. The main objective of PNE is to assist individuals in rethinking their chronic pain. The mechanism through which PNE works is reframing the way we think about pain. It is important to accept that in chronic pain, pain is not a direct measure of tissue damage and more chronic the pain it becomes less reliable gauge for tissue damage. It is also important to note that pain is influenced by physical, psychological and social factors. According to research, pain neuroscience education is a successful therapy technique for a number of chronic pain subtypes, including whiplash-related pain, neck pain in teenagers, and pain from lumbar surgery, complicated regional pain syndrome, and low back pain. PNE has advantages for participants from early adolescence to old persons. Pain Neuroscience Education is an effective method of managing pain and may be used by the physiotherapist to manage the patients with musculoskeletal conditions. Chronic musculoskeletal pain is very common complaint and research shows that pain neuroscience education is effective in pain management and physiotherapists should utilize the concept in patients as it improves patient engagement in health care.

KEY WORDS: CATASTROPHIZATION, CHRONIC MUSCULOSKELETAL PAIN, PAIN BIOLOGY EDUCATION, PAIN NEUROSCIENCE EDUCATION, RECONCEPTUALIZATION.

INTRODUCTION

The first mention of pain neuroscience education (PNE) in literature was in 2002 in patients with low back pain. (Meeus 2010). The terms pain biology education (PBE) as well as pain neurophysiology education have been used interchangeably with pain neuroscience education in literature, (Meeus 2010 and King 2016). Chronic pain is different from acute pain in its physiology and biopsychosocial impacts. Empowering the patients with knowledge regarding chronic pain mechanisms and neurophysiology alters patient's fundamental perception regarding chronic pain, (Butler 2003, Eneberg-Boldon 2020 Alfaifi and Webb 2021).

Goudman (2019) state that pain is a commonly used term for PNE and the textbook with same title serves as foundation

for PNE. The goal of PNE is to educate patients on the principles of neurophysiology of pain, nervous system sensitization, spinal inhibitory mechanisms, nervous system plasticity, and psychosocial factors that affect the experience of persistent pain, (Louw 2016, Meeus 2010, Mosely 2002 & King 2016).

The key underlying mechanism through which PNE is thought to function is re-conceptualization, which is described as the development of a new, less dangerous understanding of the nature of one's pain. In cases of chronic pain, it is important to realise that pain is not proportional to tissue injury. Chronic pain is greatly influenced by psychological and social factors, (Moseley 2007). PNE as a technique is administered by qualified healthcare professionals. It can be carried out separately or in groups. The neurophysiological concepts of chronic pain are explained to patients in simple language with the use of appealing and interesting freehand illustrations and metaphors.

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As a treatment PNE can be used alone but most frequently it serve as a foundation for comprehensive pain treatment strategy. Emerging research supports that PNE may be helpful for pain and function in the physical, psychological, and social realms, (Ryan 2010, (Moseley 2007, Moseley 2015, Moseley 2004, Louw 2011). The concept of PNE has gained importance in chronic musculoskeletal pain management. Recent years have seen an urge in literature regarding PNE. The present review was aimed to explore the methodologies through which PNE is implemented and the evidences for its effectiveness.

MATERIAL AND METHODS

An electronic search was performed covering the last 2 decades (2003 –2022). The main search items were neuroscience, neurobiology, neurophysiology, pain, pain education, pain science, education, musculoskeletal

disorders. All of the identified literature was reviewed for titles and abstracts. The selected studies on musculoskeletal pain were reviewed.

RESULTS AND DISCUSSION

Strong evidences in support of pain neuroscience education are coming up. Patients with pain are often interested in knowing what causes their pain. The biomedical education commonly uses ergonomics including anatomy, biomechanics and pathoanatomy overlooks the complex issues like central sensitization, peripheral sensitization, inhibition and neuroplasticity. Sometimes these are taken up by patients negatively and develop into fear avoidance and catastrophization. PNE embraces a biopsychosocial approach. One of the important aspects to note in PNE is pain experience. The review suggests that patients treated with PNE have less fear avoidance and catastrophizing behaviour.

Table 1. Research studies on PNE in musculoskeletal disorders

Sr. No	Author, year	Study design	Patient Population	PNE Methodology	Results
1	Meeus (2010)	RCT	Chronic fatigue syndrome	30-minute lecture on pain physiology	Pain physiology education can be a significant therapeutic strategy in the treatment of individuals with chronic fatigue syndrome and chronic pain.
2	Louw (2011)	Systemic review	Chronic musculoskeletal pain	Studies on PNE published in English language from 1999-2010	Provide strong support for the idea that both passive and active physical movements are impacted by NE.
3	Kinga (2016)	Qualitative study	Chronic musculoskeletal pain	3 Weeks pain neuroscience education	Support the idea of reconceptualization is a key process and offer practical guidance for the work required to further explore this.
4	Shepherd (2018)	A Case Report	Complex Regional Pain Syndrome (CRPS)	A total of 26 sessions on pain neuroscience education (PNE), laterality training, motor imagery, and mirror training were conducted over a nine-month period.	Long-term outcomes showed little to no fear-avoidance and catastrophizing behaviours, as well as no functional restrictions related to her foot or ankle.
5	Goudman (2019)	A Clinical perspective	Patients Undergoing Surgery for Lumbar Radiculopathy	Before and after the surgery, 2 personally customised PNE sessions (each lasting about an hour), in addition to an educational brochure.	Physical therapists can use the clinical perspective to help them implement perioperative PNE to patients having surgery for lumbar radiculopathy.
6	Watson (2019)	A mixed-methods systematic review and meta-analysis	Chronic musculoskeletal pain	Four qualitative studies (n = 50) examining patients' experiences with PNE	Data from 12 RCTs showed that PNE can, in the short- to medium-term, improve

				were included together with 12 randomised controlled trials (n = 755) reporting pain, disability, and psychosocial effects.	pain, disability, pain catastrophizing, and kinesiophobia. Data from four qualitative investigations revealed a number of crucial factors that can improve patients' experiences with PNE, such as letting patients share their own stories.
7	Corissa (2021)	Pre and post survey	Chronic pain	9 out of the 26 participants who successfully completed both the before- and after-PNE questionnaires were included in the quantitative survey results. 5 responses only were gathered for the qualitative data.	In comparison to pre-PNE scores, post-PNE scores demonstrated a statistically significant ($p = 0.02$) improvement. The qualitative aspect of this investigation showed that participants did indeed redefine pain.
8	Oosterwijk (2011)	A pilot study	Chronic whiplash associated disorders	A 30 minutes 2 education session on PNE in 2 groups is given	Data from chronic whiplash-related illnesses indicate that learning about pain physiology is associated with improvements in pain cognitions, pain thresholds, and pain-free movement performance.
9	Moseley (2003)	A randomized comparative trial	Chronic low back pain	Group education (GE) featured a single 4-hour education session with a group of 7–10 patients, while individual education (IE) involved four 1-hour teaching sessions.	The findings showed that an intervention based on a cognition-specific motor control training method combined with pain physiology education is efficient in reducing pain and impairment related to chronic LBP.
10	Alfaifi and Webb (2021)	A Case Study	Chronic plantar fasciitis pain	PNE was applied for 5 to 15 minutes of treatment with 4 other interventions. 1st was Extracorporeal Shock Wave Therapy and 2nd was the mobilization grade III and VI were used for 5 minutes every session and 3rd was Low dye taping and 4th was stretching exercises for the lower limbs.	The symptoms in this case were not entirely resolved, the patient did report improvements in their symptoms and functional abilities, which gives hope that this case may be a useful addition to future therapies.
11	Nito (2018)	Qualitative study followed a quantitative, randomized, and controlled trial	Chronic idiopathic neck pain	43 students in one high school's 10th to 12th grades were involved; 21 were in the experimental group and received pain neuroscience instruction along with neck and shoulder endurance exercises, whereas 22 were in the control group and did not get any intervention.	Adolescents with chronic idiopathic neck pain approve the intervention, which consists of education about pain neurology and exercise, and they find it relevant and suitable.

PNE, by its definition, is an educational intervention aiming to alter a patient's beliefs and cognitions regarding their pain experience, (Louw 2017). The education of pain neurophysiology goes hand in hand with de-education the common myths about the condition. PNE is usually delivered through lectures and interactive sessions. It includes pictures, stories, examples and metaphors to promote a positive and deep learning. In order to implement the PNE it becomes essential to identify various biopsychosocial factors in patients with chronic pain. Hence, somatic, cognitive, emotional, behavioural, social and motivational factors must be included in pain assessment, (Amarins 2016). This may help to identify the dominant pain mechanism (nociceptive, neuropathic and central sensitization pain).

The mechanism through which PNE works is reframing the way we think about pain. It is important to accept that in chronic pain, pain is not a direct measure of tissue damage and more chronic the pain it becomes less reliable gauge for tissue damage. It is also important to note that pain is influenced by physical, psychological and social factors. The coping and belief of patient improves due to reconceptualization of pain. This restores balance in pain mechanism and pain inhibition improves which ultimately improves health status and functioning.

The review shows level A evidence for the effectiveness of PNE in chronic musculoskeletal pain as supported by RCTs and meta-analysis. However, clinicians must consider proper assessment of pain experiences. The patients who have poor current concepts will improve with reconceptualization. Imparting PNE in language and method understandable to patient is the key to its effectiveness.

CONCLUSION

Pain Neuroscience Education is an effective method of managing pain and may be used by the physiotherapist to manage the patients with musculoskeletal conditions. Chronic musculoskeletal pain is a relatively frequent complaint, and studies have shown that education in pain neurology is useful in treating it. Physiotherapists should use this idea with patients since it increases patient involvement in their care.

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