Manual Therapy 20 (2015) 216–220

Contents lists available at ScienceDirect

Manual Therapy

journal homepage: www.elsevier.com/math

Professional issue

Exercise therapy for chronic musculoskeletal pain: Innovation by altering pain memories

Jo Nijs [a, b, c, *], Enrique Lluch Girbés [a, d], Mari Lundberg [e], Anneleen Malfliet [a, b, c], Michele Sterling [f]

[a] Pain in Motion Research Group[1]
[b] Departments of Human Physiology and Physiotherapy, Faculty of Physical Education & Physiotherapy, Vrije Universiteit Brussel, Belgium
[c] Department of Physical Medicine and Physiotherapy, University Hospital Brussels, Belgium
[d] Department of Physical Therapy, University of Valencia, Spain
[e] Department of Orthopaedics, University of Gothenburg, Sweden
[f] Centre of National Research on Disability and Rehabilitation Medicine (CONROD), Centre for Musculoskeletal Research, Griffith Health Institute, Griffith University, Australia

ARTICLE INFO

Article history:
Received 26 March 2014
Received in revised form
4 July 2014
Accepted 8 July 2014

Keywords:
Chronic pain
Exercise therapy
Sensitization
Neuroscience

ABSTRACT

Even though nociceptive pathology has often long subsided, the brain of patients with chronic musculoskeletal pain has typically acquired a protective (movement-related) pain memory. Exercise therapy for patients with chronic musculoskeletal pain is often hampered by such pain memories. Here the authors explain how musculoskeletal therapists can alter pain memories in patients with chronic musculoskeletal pain, by integrating pain neuroscience education with exercise interventions. The latter includes applying graded exposure in vivo principles during exercise therapy, for targeting the brain circuitries orchestrated by the amygdala (the memory of fear centre in the brain).

Before initiating exercise therapy, a preparatory phase of intensive pain neuroscience education is required. Next, exercise therapy can address movement-related pain memories by applying the 'exposure without danger' principle. By addressing patients' perceptions about exercises, therapists should try to decrease the anticipated danger (threat level) of the exercises by challenging the nature of, and reasoning behind their fears, assuring the safety of the exercises, and increasing confidence in a successful accomplishment of the exercise. This way, exercise therapy accounts for the current understanding of pain neuroscience, including the mechanisms of central sensitization.

1. Introduction

In acute musculoskeletal pain, the main focus for treatment is to reduce the nociceptive trigger. Such a focus on peripheral pain generators is often effective for treatment of (sub)acute musculoskeletal pain (Surenkok et al., 2009; Grunnesjo et al., 2011; Brantingham et al., 2013; Struyf et al., 2013). In patients with chronic musculoskeletal pain, ongoing nociception rarely dominates the clinical picture. Chronic musculoskeletal pain conditions including osteoarthritis (Lluch Girbes et al., 2013), rheumatoid arthritis (Meeus et al., 2012), whiplash (Curatolo et al., 2001; Banic et al., 2004; Sterling, 2010), fibromyalgia (Staud, 2002; Meeus and Nijs, 2007), low back pain (Roussel et al., 2013), pelvic pain (Kaya et al., 2013) and lateral epicondylitis (Fernandez-Carnero et al., 2009), are often characterized by brain plasticity that leads to hyperexcitability of the central nervous system (central sensitization). Growing evidence supports the clinical importance of central sensitization in patients with chronic musculoskeletal pain (Sterling et al., 2003; Jull et al., 2007; Coombes et al., 2012; Smart et al., 2012).

In such cases, musculoskeletal therapists need to think and treat beyond muscles and joints (Nijs et al., 2013). Within the context of the management of chronic pain, it is crucial to consider the concept of central pain mechanisms including central sensitization (Gifford and Butler, 1997). Modern pain neuroscience calls for treatment strategies aimed at decreasing the sensitivity of the central nervous system (i.e. desensitizing therapies).

* Corresponding author. Vrije Universiteit Brussel, Medical Campus Jette, Building F-Kine, Laarbeeklaan 103, BE-1090 Brussels, Belgium. Tel.: +32 24774489; fax: +32 26292876.
E-mail address: Jo.Nijs@vub.ac.be (J. Nijs).
[1] http://www.paininmotion.be/.

http://dx.doi.org/10.1016/j.math.2014.07.004
1356-689X/

Treatments capable of desensitizing the central nervous system in patients with chronic pain have been proposed, including exercise prescription (Mease et al., 2011; Woolf, 2011; Nijs et al., 2011a; Lluch Girbes, Nijs, 2013), but up to now exercise therapy as a potential desensitizing treatment (Nijs et al., 2012) for chronic musculoskeletal pain has not been adequately addressed. Here it is explained how musculoskeletal therapists can integrate pain neuroscience education (Butler and Moseley, 2003; Nijs et al., 2011b) with exercise interventions, and how they can apply graded exposure in vivo principles (Vlaeyen et al., 2012) during exercise therapy for patients with chronic musculoskeletal pain. Together, the treatment proposed here aims at altering pain memories in patients with chronic musculoskeletal pain.

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

2.1. Prerequisites for the therapist to provide cognition-targeted exercise therapy

The therapist should have certain prerequisites for providing cognition-targeted exercise therapy. First, therapists require an in-depth understanding of pain mechanisms (Butler and Moseley, 2003) and the dysfunctional central nociceptive processing in those with chronic musculoskeletal pain (Woolf and Salter, 2000; Woolf, 2011). This includes a thorough understanding of the role of fear (of movement) in the development and sustainment of chronic pain (Vlaeyen and Crombez, 1999). Second, therapists require the skills to explain to their patients the mechanism of central sensitization as an evidence-based explanation for their chronic musculoskeletal pain (Nijs et al., 2011a; Puentedura and Louw, 2012). Third, specific communication skills are required. For instance, a Socratic-style dialogue of education (Siemonsma et al., 2008) is preferred over 'lecturing' to the patient. Fourth, therapists should be familiar (and preferentially experienced) with current evidence-based biopsychosocially-driven pain management strategies including graded activity (Macedo et al., 2010), graded exposure in vivo (de Jong et al., 2005), and acceptance-based interventions (e.g. acceptance and commitment therapy) (Wicksell et al., 2008, 2010). Finally, therapists should have the skills to apply a variety of exercise interventions, including neuromuscular training (Richardson and Jull, 1995; Jull and Richardson, 2000; Jull et al., 2008).

2.2. Preparing patients for cognition-targeted exercise therapy using therapeutic pain neuroscience education

Before implementing cognition-targeted exercise therapy, a preparatory phase implying deep learning and reconceptualization of pain, is proposed. It can be accomplished by providing intensive pain neuroscience education, which should mostly rely on evidence from modern pain neuroscience rather than from psychology (Nijs et al., 2011b). If not, patients often misunderstand the neuroscience education message and believe that they are being told "the pain is all in your head", which is a common pitfall of this approach. In addition, the crucial point in all kind of cognition-targeted therapy is that it starts from the patient's perspective (including pain cognitions and beliefs (Nicholls et al., 2013)) and expectations for care (Macfarlane et al., 1997). Guidelines for enabling clinicians to apply pain neuroscience education in clinical practice are available (Nijs et al., 2011b; van Wilgen and Keizer, 2012), and imply the use of an information leaflet or an explanatory handbook (e.g. Explain Pain (Butler and Moseley, 2003)). This approach assumes that the patient will be intelligent enough to understand the information provided. Before considering step 2, it is first necessary to have a closer look at the role of movement-related fear in the pain neuromatrix.

3. The role of fear (of movement) in the pain neuromatrix

In those with central sensitization pain, the pain neuromatrix is likely to be overactive: increased activity is present in the insula, anterior cingulate cortex, prefrontal cortex, various brain stem nuclei, dorsolateral frontal cortex and the parietal associated cortex (Seifert and Maihofner, 2009). Long-term potentiation of neuronal synapses (Zhuo, 2007), as well as decreased gamma-aminobutyric acid-neurotransmission (Suarez-Roca et al., 2008) represent two mechanisms contributing to the overactive pain neuromatrix.

One key brain area involved in the pain (neuro)matrix is the amygdala, often referred to as the fear-memory centre of the brain. The amygdala has a key role in negative emotions and pain-related memories (Li et al., 2013). In addition to the amygdala, the anterior cingulate cortex takes part of the central fear network in the brain (Kattoor et al., 2013). Recent research supports the cardinal role of the amygdala as a facilitator of chronic pain development, including sensitization of central nervous system pain pathways (Simons et al., 2012; Hadjikhani et al., 2013; Kattoor, Gizewski, 2013; Kim et al., 2013; Li, et al., 2013; Schwedt et al., 2013). In line with this is the finding that the amygdala, as well as the somatosensory cortex and insula, shows less activity during pain delivery in case of positive treatment expectations (Schmid et al., 2013).

Of major relevance for providing exercise therapy to patients with chronic musculoskeletal pain is the amygdala's role in pain memories, and more precisely in memories of painful movements. Therefore the amygdala closely collaborates with the hippocampus and the anterior cingulate cortex. Even though nociceptive pathology has often long subsided, the brain of patients with chronic musculoskeletal pain has typically acquired a protective pain memory (Zusman, 2004). For movements that once provoked pain, this implies protective behaviours (e.g. antalgic postures, antalgic movement patterns including altered motor control, or even avoidance of such movements).

Kinesiophobia or fear of movement is seldom applicable to all kinds of physical activity, but rather applies to certain movements (e.g. neck extension in patients post-whiplash, overhead smashes in patients with shoulder impingement syndrome, or forward bending in patients with low back pain). Even though these movements provoked pain in the (sub)acute phase, or even initiated the musculoskeletal pain disorder (e.g. the pain initiated following an overhead smash), they are often perfectly safe to perform in a chronic stage. The problem is that the brain has acquired a long-term pain memory, associating such movements with danger/threat. Even preparing for such 'dangerous' movements is enough for the brain to activate its fear-memory centre and hence to produce pain (without nociception), and employ an altered (protective) motor control strategy (Tucker et al., 2012). Exercise therapy can address this by applying the 'exposure without danger' principle (Zusman, 2004), which is detailed below.

4. Step 2: Cognition-targeted exercise therapy for chronic musculoskeletal pain

Following pain neuroscience education, as soon as the patient with chronic pain understands that all pain is produced in the brain and has adopted less threatening perceptions about pain, one can proceed to the next level: cognition-targeted exercise therapy (Nijs et al., 2014). Here it is explained how therapists can use cognition-targeted exercise therapy for altering pain memories in patients with chronic musculoskeletal pain and central sensitization. Such exercise therapy can include various types of exercise interventions