Reconciling movement and exercise with pain neuroscience education: A case for consistent education

Cory Blickenstaff, PT, MS, OCS and Neil Pearson, PT, MSc (RHBS), BA-BPHE

Forward Motion Physical Therapy, Vancouver, WA, USA; Department of Physical Therapy, University of British Columbia, Penticton, BC, Canada

ABSTRACT
This article will introduce a conceptual framework of kinesthetic education that is consistent with and reinforces pain neuroscience education. This article will also provide some specific guidance for integrating pain neuroscience education with exercise and movement in a more congruent manner. Our belief is that this will enhance the effectiveness of specific movement approaches such as graded exposure techniques. Over the past decade, a new paradigm of pain education has been explored in an effort to improve patient outcomes. Using advances in pain neuroscience, patients are educated in the biological and physiological processes involved in their pain experience. Growing evidence supports the ability of pain neuroscience education (PNE) to positively impact a person’s pain ratings, disability, pain catastrophization, and movement limitations. What is often overlooked, however, is the consistency between the messages of PNE and those of other therapeutic interventions, including movement therapies. This article proposes the following: education provided in isolation will be limited in its impact; the addition of guided purposeful movement performed in a manner consistent with PNE may be vital to the desired behavioral changes, and when inconsistent messages are delivered between education and movement interventions, outcomes may be adversely impacted.

ARTICLE HISTORY
Received 12 November 2015
Revised 3 January 2016
Accepted 25 February 2016

KEYWORDS
Exercise; graded exposure; guidance; movement; neuroscience; pacing; pain

Introduction
Growing interest and support for pain education and neuroscience-based interventions for people in pain have pushed these approaches toward the mainstream (Moseley and Butler, 2015; Nijs et al, 2011). Both pain neuroscience education and exercise have demonstrated impact on factors known to be associated with the physiology, development, progression, persistence, and recovery from pain and disability (Moseley, 2002; Nijs et al, 2011). Physical therapists, who are traditionally well versed in approaches to movement and exercise, may grow frustrated when attempting to reconcile these approaches and incorporate them into practice. Re-conceptualizing movement intervention as a form of education, one that is communicated kinesthetically, can assist in reconciling these treatment approaches (O’Sullivan, Dankaeits, O’Sullivan, and O’Sullivan, 2015). Alterations in the meaning of the experience of pain and the physiology associated with pain occur together (Moseley, 2004). We should acknowledge the importance of kinesthetic education as a means to alter both the experience of pain and pain physiology. This paper will introduce a conceptual framework of kinesthetic education that is consistent with and reinforces pain neuroscience education. This article will also provide some specific guidance for integrating pain neuroscience education with exercise and movement in a more congruent manner. Our belief is that this will enhance the effectiveness of specific movement approaches such as graded exposure techniques.

Movement/exercise as an approach to pain

Since Richard Deyo’s landmark publication in 1986 regarding active care versus bed rest for patients with acute low back pain (Deyo, Diehl, and Rosenthal, 1986), guidelines for management of painful conditions have increasingly advised movement and activity (Waddell, Feder, and Lewis, 1997) to the point of being nearly ubiquitous. It is clear that movement is commonly effective for painful conditions. In the case of chronic pain, effectiveness of exercise programs have been demonstrated in populations of: chronic neck pain (Childs et al, 2008; Cuesta-Vargas, González-Sánchez, and Casuso-Holgado, 2013; Stewart et al, 2007; Teasell et al, 2010); osteoarthritis (Cuesta-Vargas, González-Sánchez, and Casuso-Holgado, 2013;
Jansen et al., 2011); headache (Darling, 1991); fibromyalgia (Brosseau et al., 2008); and chronic low back pain (Cuesta-Vargas, González-Sánchez, and Casuso-Holgado, 2013; van Middelkoop et al., 2010). What is often less clear, clinically, is how these various intervention approaches should contribute to a comprehensive episode of care. A key contributor to this difficulty is the indication that in some chronic pain populations the magnitude and direction of the effect sizes are highly variable in response to exercise as compared to acute and subacute populations (Daenen, Varkey, Kellmann, and Njis, 2015).

Graded exposure and graded activity programs have been shown to be particularly promising approaches for chronic pain problems (Boersma et al., 2004; de Jong et al., 2005; Leeuw et al., 2008; Linton et al., 2008; Vlaeyen et al., 2001; Woods and Asmundson, 2008). However, when compared against each other and other exercise interventions, the results tend to be equivocal (George, Wittmer, Fillingim, and Robinson, 2010; López-de-Uralde-Villanueva et al., 2015; Macedo, 2010; Rasmussen-Barr, Ång, Arvidsson, and Nilsson-Wikmar, 2009). Graded activity programs work on quota based systems in which a set amount of increase at a predetermined rate is employed in an operant conditioning model, while exposure based models attempt to extinguish the response to feared activities through desensitization under controlled conditions (Lindström et al., 1992; Main et al., 2015; Riecke, Holzapfel, Rief, and Glombiewski, 2013; Vlaeyen et al., 2012). It is clear that neither approach is effective for all chronic pain patients and that factors such as catastrophizing can predict a poorer outcome to these methods (Flink, Boersma, and Linton, 2010; Leeuw et al., 2006; Zale, Lange, Fields, and Ditre, 2013). These research findings suggest that the success of exercise approaches is in part dependent upon how the approach is integrated with psychosocial targets.

Further bolstering the relevance of psychosocial factors is the fact that despite the clear presence of physical impairments, such as specific strength and mobility changes, nothing appears to be gained by providing exercises to specifically address them. As a case in point, a program aimed at stabilization of the low back was no more effective than a general exercise approach despite specific impairments of the stabilizer muscle groups (Smith, Littlewood, and May, 2014). This may also be evident in the case of deconditioning. It would be logical to assume that those in chronic pain display high levels of deconditioning due to reduced tolerance to activity and progression of physical impairments. However, Bousema et al. (2007) found this not to be the case, again pointing toward the conclusion that something beyond physical impairment is being addressed when individuals respond positively to exercise and movement. While psychosocial targets are a clear target for intervention, they also pose as significant barriers to recovery.

**Barriers to movement as an education intervention**

Pain research includes numerous theories and studies of the barriers that limit the recovery of people with chronic pain. Yet, because pain is a biopsychosocial phenomenon, the search for those factors that limit recovery should include a more integrated view of barriers. Biological and physiological factors related to chronic pain may be as important as cognitive, emotional and vocational factors. Alterations in nervous system sensitization, changes in interoception, and physiological arousal (Loggia, Juneau, and Bushnell, 2011) are among the biological processes that should be considered in an expanded biopsychosocial perspective on barriers to recovery. This section presents several specific examples of barriers that exist within these realms.

**Those with chronic pain often display an impaired endogenous pain inhibitory system and a hyperalgesic response to exercise**

Several chronic pain populations have demonstrated impaired pain inhibition (Lewis, Rice, and McNair, 2012) which is typically evaluated through measurements of conditioned pain modulation (Yarnitsky et al., 2015) and exercise induced hypoalgesia (Lannersten and Kosek, 2010). These groups often respond to exercise with hyperalgesia while those without the impairment respond with hypoalgesia (Vaegter, Handberg, Graven-Nielsen, and Edwards, 2016). To date, we lack sufficient normative values for neural sensitization to make measurement of sensitization clinically useful, even though considerable research shows that persisting pain increases the responsiveness and reactivity of many aspects of the nervous system (Coombes, Bisset, and Vicenzino, 2012; Jull, Sterling, Kenardy, and Beller, 2007; Paul, Soo Hoo, Chae, and Wilson, 2012; Roussel et al., 2013; Suokas et al., 2012; van Wilgen et al., 2013).

**The impaired endogenous pain inhibitory system is associated with catastrophic beliefs, a heightened sensitivity to pain, a lower threshold to pain, and facilitation of temporal summation of pain**

In chronic pain, those with high sensitivities have been found to have associated catastrophic beliefs and are
within the sub-group who demonstrate an impaired endogenous inhibitory pain modulation (Lewis, Rice, and McNair, 2012; Naugle, Fillingim, and Riley, 2012). Additionally, they display an increase in temporal summation of pain, where repeated exposure to a stimulus increases the amount of pain. People with low pain sensitivity tend to show the opposite effect. Catastrophic beliefs, having three elements; helplessness, magnification, and rumination have been shown to be involved in numerous poor prognostic indicators (Peters, Vlaeyen, and Weber, 2005; Sullivan, Lynch, and Clark, 2005; Turner, Mancl, and Aaron, 2004). These have been found to mediate changes seen in both physical and cognitive behavioral treatments (Smeets, Vlaeyen, Kester, and Knottnerus, 2006), and impact involvement in exercise participation (Goodin et al, 2009). The graded exposure approach mentioned above more predictably demonstrates effectiveness in populations with low to moderate catastrophizing scores. Those with high catastrophizing scores, typically identified through the pain catastrophizing scale (PCS) (Sullivan, Bishop, and Pivik, 1995), appear to be the specific group who do not respond to graded exposure (Flink, Boersma, and Linton, 2010). Therefore, both identification using the PCS and interventions related to this finding, possibly including referral to a behavioral health specialist, are keys to working with this population.

**Chronic pain patients demonstrate cortical reorganization and imprecise neural coding of proprioceptive and exteroceptive sensory events**

Spatial and proprioceptive acuity is impaired in people with chronic pain as they demonstrate disruptions in the perceived size, location, and ability to mentally maneuver body parts (Wand et al, 2011). They also demonstrate altered tactile acuity (Catley et al, 2014), a test of exteroception. These sensory events are encoded in cortical representations less precisely in people with chronic pain than they are in people with acute pain or in healthy controls (Moseley and Vlaeyen, 2015). Tactile acuity training has shown changes in pain that were positively associated with cortical re-organization (Flor, Denke, Schaefer, and Grüsser, 2001).

**Low sensitivity of interoception is associated with reduced self-regulation**

Sensation of the internal states or physiologic conditions of our body is known as interoception. One’s homeostatic state, although normally controlled automatically below our awareness, can be consciously self-monitored (Tsay, Allen, Proske, and Giummarra, 2015). It has been suggested that the perception of one’s status of homeostasis (the level of threat to one’s well-being) contributes to the overall stress response implicated in chronic widespread pain (Lyon, Cohen, and Quintner, 2011). Individuals who demonstrate higher interoceptive sensitivity also demonstrate a higher capacity for self-regulation (Weiss, Sack, Henningsen, and Pollatos, 2014). This apparently enables them to override and alter their responses (Vohs et al, 2008) via self-monitoring, appraisal, and subsequent conscious reactions (Maes and Karoly, 2005). For example, interoceptive sensitivity may allow one to become aware of the increased heart rate of a stress response and subsequently react to self-regulate breathing and thoughts.

The benefit of heightened interoceptive sensitivity seems at odds with findings of hypervigilance, a compulsive monitoring for painful sensation, which is associated with a poorer prognosis. However, it has been suggested that interoception is a multifaceted concept with two realms relevant in the case of hypervigilance; interoceptive sensitivity and the interpretation of the sensations (Yoris et al, 2015). It appears that they are those with a combination of high interoceptive vigilance and catastrophic beliefs with passive coping strategies which have poorer prognoses (Meredith, Rappel, Strong, and Bailey, 2015). Additionally, the narrow intense focus of individuals on pain sensation at the expense of experiencing subtle non-pain sensations of the body may contribute to a lack of self-regulating activity. For example, while a person with low interoceptive sensitivity may have difficulty recognizing the presence of a stress response, a hypervigilant person would not only recognize the sensation as a sign of a stress response, but may also attribute the sensation to a worst-case scenario such as having a heart attack (catastrophizing), the thought of which would worsen the stress response, facilitating maladaptive responses, and further worry them about their situation. This inability to self-assess and to regulate physiological arousal may also be significant barriers to recovery. Pain alters the hypothalamus-pituitary-adrenal (HPA) axis (McBeth et al, 2005) and is associated with increased sympathetic activity (Loggia, Juneau, and Bushnell, 2011). With disrupted interoception, people in pain may not self-assess the need for regulation, and may also lack skill in self-regulation of physiological arousal.

**Pain, disability, and their change over time relate to recovery expectations and coping behavior**

Poor recovery expectations have been demonstrated as predictive of those who will have a poor outcome in chronic low back pain populations (Iles, Davidson,
They have also been shown to be quite changeable and in fact are often cited as a target of the placebo response. When an individual’s beliefs are altered to include the possibility of improvement, greater improvements are seen (Vase, Petersen, Riley, and Price, 2009).

The manner in which one copes with pain also has a large impact on the outcome. Both avoidance behavior and endurance behavior (where the symptoms are ignored) are poor prognostic indicators (Hasenbring and Verbunt, 2010; Linton, Buer, Vlaeyen, and Hellings, 2000). A well-studied example of avoidance behavior relates to kinesiophobia or fear of movement. Fear of movement has been shown to mediate the disability and pain intensity at onset of chronic pain (Costa and Maher, 2011). Conversely, there are findings to suggest that, in the context of a painful experience, the active coping behavior of sensation seeking may constitute a protective factor (Meredith, Rappel, Strong, and Bailey, 2015).

Related to both recovery expectations and coping strategies is self-efficacy, which indicates the degree to which a person believes that they can: 1) get through a problem; and 2) do so of their own accord, have been found to mediate catastrophizing (McKnight et al, 2010). In a study by Costa and Maher (2011), self-efficacy was shown to mediate the changes in pain intensity and disability during the course of care and disability and pain intensity at onset of chronic pain (Table 1).

Generally, barriers to recovery are those factors that are associated temporally with a condition, that the presence of the finding predicts poorer outcomes, and that there is a negative correlation between severity of the barrier and likelihood of treatment success. Many of these clinical findings listed in Table 1 may also have potential associations with nervous system sensitization, altered interoception, and physiological arousal. Physiotherapists have the ability to assess whether their interventions have an influence on the majority of these, and should consider that like many barriers to recovery, when we are able to address the barrier, this is associated with clinical improvements.

### Pain neuroscience education is an effective way to alter beliefs related to pain, which interfere with the success of exercise interventions

Pain neuroscience education has been shown to be effective in changing pain beliefs including catastrophizing (Meeus et al, 2010; Moseley, 2004) and kinesiophobia (Van Oosterwijk et al, 2011); improving health status and reducing healthcare expenditure in adult patients with various chronic pain disorders (Louw, Diener, Butler, and Puenteuda, 2011; Louw, Diener, Landers, and Puenteuda, 2014; Meeus et al, 2010; Moseley, 2002; Moseley, 2003; Moseley, 2004; Moseley, 2005; Moseley, Nicholas, and Hodges, 2004; Van Oosterwijk et al, 2011; Van Oosterwijk et al, 2013). Additionally, it has been shown to impact impaired endogenous pain inhibitory responses (Van Oosterwijk et al, 2013) and therefore impacts factors important for those who often prove resistant to care. Pain neuroscience education is a cognitive approach as it seeks to change beliefs and cognitions related to pain. When cognitive experiences are introduced that are inconsistent with the belief that pain equates with the state of the tissues, the threat value of pain and injury are potentially decreased. This opens the door for individuals to consider the influence they have over regaining movement and function while decreasing pain. It appears that when individuals understand more about pain physiology they will alter the manner in which they approach movement, exercise and activity. Pain with movement is no longer seen as an experience to endure or as an experience from which to flee. Thus, individuals are able to repeat movements with greater ease and frequency to create adaptive improvements in pain physiology.

In an excellent summary, Nijs and Meejus (2015) indicated several factors need be present for a cognitive approach to have effect. They specify that: 1) Only patients dissatisfied with their current perceptions about pain are prone to reconceptualization of pain (Siemonsma, Schröder, Roorda, and Lettinga, 2010; Siemonsma et al, 2008; Siemonsma et al, 2013); 2) any new explanation must be intelligible to the patient (Siemonsma, Schröder, Roorda, and Lettinga, 2010;
Both movement and cognitive approaches serve as education and need to be consistent

Aligning exercise prescription and instructions with the key messages of pain education may be critical to success (Ryan, Gray, Newton, and Granat, 2010) indicating that the manner in which other interventions are prescribed to a person with chronic pain should be consistent with the messages of pain neuroscience education. For example, a new more optimistic view of pain could be nullified if the instructions for exercise indicate that pain is to be avoided and indicative of tissue damage. Confusion may ensue if exercise instructions after pain education do not include any focus on the individual’s sense of safety or threat related to the exercise. Pain neuroscience education intends to provide compelling experiences convincing the individual that there is less threat than they previously considered, while also providing optimism for improved pain and function. This task becomes difficult for the educator when the messages of PNE are contrary to what the learner has been taught by others about pain. The final section of this paper provides examples of movement instruction informed by pain science.

It has also been suggested that for change to occur, exploration and experimentation need to happen in both the mental and physical realms (Siemonsma et al, 2008). Both pain neuroscience education and exercise/movement potentially provide these experiences, and should both be considered as educational opportunities. Pain neuroscience education alters the threat value of movement, while subsequent movement confirms or refutes this new belief while providing repeated sensory inputs required for creating enduring shifts in the automatic movement and stress response. The sensory and experience-rich environment of movement and exercise is kinesthetic education. A combination of verbal and kinesthetic education may be the best approach to bring about change, however highly experiential learners may be best suited to a kinesthetic dominant approach (Alkhasawneh et al, 2008; Murphy, Gray, Straja, and Bogert, 2004). As Nijs and Meeus (2015) pointed out, the new explanation of pain should be confirmed by the patient’s environment. The experiences of movement and exercise prescription be negative then there is potential for negative effects on new pain beliefs and recovery attitudes. As an example, movement and exercise are opportunities to experience direct proof that movement is not so dangerous. When we move in a way that feels safe and does not worsen the pain, we learn that ease of movement and pain can be changed. Additionally, repeated positive movement experiences may assist in extinguishing persistent pain neurotags, and restoring body awareness and body schema. Based on these concepts, how should we guide our patients to approach movement, based on pain science?

Presentation of guidelines for moving in the face of pain

With these concepts and findings in mind the following two sets of guidelines are presented to employ verbal and kinesthetic education to the person in pain. The first guideline is intended as a starting point, for practitioners new to integrating pain neuroscience education into exercise prescription, and without a background in employing cognitive principles into their interventions. The second guideline walks through a more complex interaction placed within a broader intervention context.

Guideline 1: The simple interaction

Guide the patient to move their body or limb to the position at which they report a slight increase in pain intensity, just perceptibly above their baseline intensity. Once there, the patient is instructed to ask two questions: “Is this (movement or position) safe for my physical body?” and “Will I be okay later (if I move this much or stay in this position)?”

With some practice and effort, the patient will find an amount of movement or postural change that feels safe, and that won’t likely flare the pain. At this point the patient is directed to divide their attention between their breath, body tension and the pain. Once aware of these, the patient is instructed to do their best to keep their breath calm and their muscle tension low, while also attending to the pain, allowing self-monitoring that is unlikely to become hypervigilant or distracted.
Keeping one’s thoughts calm, while keeping breath and body tension calm, is intended to alter sensory inputs in a manner consistent with the individual’s appraisal of safety. In other words, avoiding holding one’s breath, breathing shallulously, and tensing up the body are intended to alter sensory inputs in order to decrease the threat value of the movement. Monitoring the pain also decreases the threat value of movement, allowing the individual to avoid pushing through the pain into a flare up, and avoid becoming hypervigilant.

Consistent with pain neuroscience education, these guidelines provide an opportunity to experience movement that does not worsen the pain. Additionally, this guide allows the patient to individualize movement and exercise (Table 2).

**Case example one**

Your patient with chronic low back pain reports pain with rolling from crook lying to either side. Until he was provided pain neurophysiology education, he believed this was dangerous for his back. After the education he states that he is considering whether this might not be so dangerous, yet he is skeptical.

From a crook lying position, we ask him to roll his knees to the side that hurts less, or he feels is more safe. He is instructed to move only to a point at which there is a slight increase in pain, and then return toward center. He is asked “do you believe that was a safe movement – one that did not harm your body?”. If he says it was not safe, then he is asked to move only to a spot at which he feels safe. Once he has found that amount of movement, he is asked a second question, “Will you be okay later?” If he believes he will regret moving this much, the movement is modified again. Once he finds an amount of rolling his knees to the side that he believes isn’t dangerous and that he won’t regret later, he is asked to repeat the movement while attending to his breath, his muscle tension, and his pain. The PT observes the patient’s breathing pattern and muscle tension, helping to guide him to avoid rapid and shallow breaths, breath holding, or tensing of his muscles during the movement. The PT also guides him in the importance of attending enough to the pain to ensure he will not flare up, and not so much to become hypervigilant.

There are some key points for success with these guidelines. First, do not stop as soon as the pain increases, breath gets tight, or body tension increases. When the patient states that he cannot keep his body or breath calm, the first thing to do is ask him the same questions again, and then ask him to try harder to calm his breath and body. If doing this does not decrease the threat, then it is time to stop for now. If the movement no longer feels threatening, then he should stay longer. Second, success with these guidelines may be limited by interoception sensitivity issues and ability to self-regulate. Some individuals will require guidance and practice with maintaining longer smoother breathing patterns, and with reducing muscle or body tension, in order to perform movements in a manner that does not provide the brain with evidence that there is something dangerous happening in the body.

**Guideline 2: The complex interaction**

**Educate in the language of physiology before that of psychology**

Education is vital throughout the course of care, however, in many cases it may be the primary intervention at the outset of an episode. It is clear that many if not most patients present with the belief that their problem relates to some combination of anatomical or physiologic pathology (Nijs et al, 2015). These patients will initially be skeptical of a fear avoidance behavior approach to education (Nijs et al, 2015) as is typically used at the outset of graded exposure protocols (Vlaeyen et al, 2001). Pain neuroscience education, which approaches biopsychosocial education through the lens of physiology, is therefore well suited to the task of challenging those assumptions and laying the groundwork for the movement work ahead.

**Address responses through graded exposure approaches**

In graded exposure, the patient is repetitively exposed to a triggering stimulus with the goal being a gradual extinction of the response through desensitization (Main et al, 2015; Vlaeyen et al, 2012). Other cognitive behavioral therapy principles are applied during the course of care and this guideline will present some novel approaches to be used in this regard.

An important early step is determining a hierarchy of those items that the patient finds to be triggering. This may be done simply through various means of interview and examination or more systematically
through use of tools such as questionnaires. Pick a low threat task or task component from the hierarchy as the first target of intervention. For example, if the patient finds bending and turning at the trunk to be a trigger, the first target could be to expose the patient to a low intensity trunk rotation. Move to the point of the trigger to find the level of tolerance of performing the motion. The patient is to monitor for the first signs of the trigger; changes in breathing, in perceived muscle tension, in pain, or a general feeling of unease. This is the point of appraisal. If the processes of reduced temporal summation and of extinction of response are active one would expect to see a reduction in the expression of these findings with repeated exposures. Slow and controlled movements up to and away from this point of appraisal are completed. However, as noted earlier, patients with chronic pain often demonstrate the opposite effect having an increase in temporal summation (Vaegter, Handberg, Graven-Nielsen, and Edwards, 2016) with a resulting hyperalgesia and wind up of pain. Education is a key here, as this response tends to associate with beliefs such as catastrophizing (Lewis, Rice, and McNair, 2012; Naugle, Fillingim, and Riley, 2012).

Graded exposure protocols often suggest the implementation of a general “relaxation” intervention to teach skills of gaining control over reactions (Meeus et al, 2015). A more specific application would be to ask the patient to attend to their breathing and muscle tension at the point of appraisal and during the movement in question. Also, the appraisal itself is addressed through pointed questions asking the patient to consider the present and future safety for having engaged in the task this way. Attending to responses in this way has evidence of increasing the extinction response (Tsay, Allen, Proske, and Giummarra, 2015).

At the point of appraisal, specific interventions may be applied in an attempt to reduce the perceived threat level of the movement or situation. This may take the form of a “cognitive challenge” in which the patient is asked to consider alternative ways of thinking about the problem and thereby alter the cognitive response (Vlaeyen et al, 2012). Pain neuroscience education is well suited to this task. However, an additional approach is to alter sensory input at the point of appraisal. This can be done in any number of ways, such as alterations in the position, addition of an isometric muscle contraction, or even the addition of manual contact. But, a simple example is to start with altered breathing and muscle tension, to which the patient has at this point already learned to attend. Simply having the patient actively breathing slowly and fully and actively attempting to reduce the muscle tension at this point may serve as an alteration of sensory input sufficient to reduce the perceived level of threat. Thus the patient has learned an active coping strategy that can be applied to their response to movement and pain. This is consistent with Zusman’s concept of “exposure without danger (Zusman, 2004).”

A common graded exposure practice is that of pacing, in which a patient “paces” their activities throughout the day based on a quota or amount of activity (Nielsen, Jensen, Karsdorp, and Vlaeyen, 2013). Pacing has little support of effectiveness (Nielsen, Jensen, Karsdorp, and Vlaeyen, 2013). Alternatively, what may be done is to educate the patient to utilize the skills that they have learned of attending to the movements and activities of their life. Thus, instead of pacing based on an amount of movement, they have attended activity, based on the manner and response to movement which is a more active coping behavior.

**Address pain behavior through graded activity**

Graded activity typically consists of establishing an amount of activity that the patient feels safe participating in, and then the patient and therapist agree on a set amount of increase in activity over a given time. This is a quota based system. Importantly throughout the graded activity process, the patient re-establishes “well behavior”. A graded exercise program is often used for this process and Fordyce claimed that exercise is always a well behavior (Main et al, 2015). As mentioned earlier, forms of graded exercise have been shown to be as effective as other programs focused on graded functional activities (Rasmussen-Barr, Ång, Arvidsson, and Nilsson-Wikmar, 2009). However, graded activity presents an opportunity to provide education within the context of relevant functional activities.

As exercise programs are commonly explained using the language of strain, recovery, and tissue response, these explanations could very easily provide an inconsistency with the pain neuroscience education. It is vital that all forms of education have consistency. Otherwise, the various forms of intervention will devalue each other, perhaps rendering a portion or the entirety of the program ineffective. Clear language, consistent with pain education, asserts that the initial intention of movement and exercise is to impact the nervous system. As such, improvements are expected to occur following timelines more akin to motor learning than to tissue responses.

**Case example two**

This case highlights some specific examples of use of these guidelines at the point of the beginning of
exposure movements. As a part of the initial encounter it is identified that the patient has most difficulty and pain with lifting and has expressed fear that this may indicate a more significant problem that has not yet been identified. As time has gone by, all of his motions and positions of the back have become increasingly limited and painful. Based upon the interview and examination, including the patient specific functional scale, it is determined that motions and activities involving rotational motions are lower on the hierarchy of threatening movement, while bending forward, and ultimately lifting are higher.

A discussion ensues regarding the patient’s beliefs about their pain and the therapist facilitates the discussion taking place in terms of the impact that they have on the valued activities. Examination findings are discussed and as appropriate reassurance and recovery expectations are addressed using open ended questioning. Pain neuroscience education is used to create a reasonable context for the presence and nature of their pain and the patient is invited to begin exploring motion.

With the patient in crook lying, they are asked to let both of their knees lower slowly to one side as far as they feel that they can safely go, return to the starting position and repeat to the other side. They are questioned about what they felt during the movement and why they stopped where they did. They are then asked to repeat the motion, but this time they are to stop at the first sign of anything that they would consider to be a protective response. They are advised that this is the point of reappraisal, the “edge” (Blickenstaff, 2015), and it could be an alteration in muscle tension, breathing, pain, or even a general feeling of unease. If breath holding or preparatory muscle tension is noted they are actively encouraged to keep their breathing calm and muscles relaxed. Once they have demonstrated the skill of finding this point of reappraisal, they are taken through a series of approaches.

(1) They move up to the point of appraisal and then immediately back to the starting point repetitively. They are encouraged to attend to and find that point each time instead of trying to match a particular position. They are actively questioned as to any changes in response, quality, or amount of motion and if any changes are observed they are pointed out to the patient.

(2) Next they move up to the point of appraisal again, and while staying at that position take 3 full breaths and then return to the starting point. Then they immediately move to the point of reappraisal again while actively looking for change. This is then repeated numerous times, always attending to the motion and any changes.

(3) They are again asked to move to the point of reappraisal with their knees, and while staying at that position, they push their palms together in an isometric contraction holding for three breaths, and then relaxing the arms and returning the knees to the starting point. Again they immediately return to the point of reappraisal while actively looking for change.

Many other forms of sensory input may be applied at the point of reappraisal, such as altering the position of a body part or even applying manual therapy. Caution in the selection of the altered sensory input should be taken with the purpose of encouraging active coping behaviors. This is also a point with the “cognitive challenge” process may be completed. For example, if the patient had expressed concerns about a spinal degeneration, a discussion could ensue about how simply breathing could have no impact on the presence of degenerative findings which could lead into a productive pain neuroscience discussion. At subsequent sessions, the complexity and level of prior stress of the chosen movement is increased. For example, the process could next be applied to a rotational movement done in sitting or standing or in a functional context such as rolling in bed. This progression continues toward those motions that were indicated as being more stressful, namely forward bending and lifting.

The patient describes some familiarity and enjoyment in the past with resistance training. While standing in their most comfortable position they demonstrate the ability to perform multiple sets of isometric exercises of the shoulders, knees, and ankles without increasing their symptoms. Patient and therapist agree on a set amount of increase per week in the repetitions and duration of holds performed of the exercises. This is to be the start of the graded activity program. The effect of isometrics to elicit exercise induced hypoalgesia is discussed as is the effectiveness of exercise in painful populations. The purpose of the exercise is clearly explained as being aimed at well behaviors and not strength, per se. Additionally, the patient is reminded of how they learned to respond to their symptoms during the crook lying movement and taught how this could be applied during the graded activity process as well.

Conclusion

Clinical pain science provides guidance for innovations in exercise and movement prescription as well as
instruction for people with persistent pain. Inconsistencies derived from differing historical philosophies of care are pervasive in common practice. Equally important, previous guidelines have not considered exercise and movement as an educational modality. The guidelines in this paper were created in attempt to reconcile these issues based upon the available evidence. However, the reader is cautioned that these guidelines themselves have not been subjected to specific scrutiny through scientific enquiry at this point.

References


