Therapeutic approach to pain-related fear and avoidance in adults with chronic musculoskeletal pain: an integrative review and a roadmap for clinicians

Abordagem terapêutica do medo relacionado à dor e da evitação em adultos com dor musculoesquelética crônica: revisão integrativa e roteiro para o clínico

Gisele Harumi Hotta[1], Anamaria Siriani de Oliveira[1], Rafael Krasic Alaiti[1,2], Felipe José Jandre dos Reis[1,3,4]

DOI 10.5935/2595-0118.20220015

ABSTRACT

BACKGROUND AND OBJECTIVES: Cognitive-behavioral approaches have been applied in patients with chronic pain as a treatment strategy to reduce symptoms and disability, since fear related to pain, kinesiophobia and catastrophizing may be important psychosocial barriers for recovery. The relevance of fear and avoidance behaviors in the development and maintenance of processes of disabling chronic pain is already well established in the scientific literature.

CONTENTS: The cognitive-behavioral approach defines the relationship of pain with defense behaviors and the contribution to functional disability, assisting clinicians to recognize signs of these defensive behaviors during practice, as well as providing strategies for clinical practice, highlighting approaches that can be used, such as pain neuroscience education and exposure therapy. Therefore, it is possible to provide a guide to facilitate the implementation of these concepts in clinical practice for the management of chronic musculoskeletal pain, helping clinicians to ground the theories of fear learning and avoidance in the context of pain and to address the psychosocial factors of patients who present an association between pain and movement.

CONCLUSION: Pain-related fear and catastrophic thoughts influence pain intensity and functional disability. Recognizing pain within a multidimensional context assists in establishing targeted approaches. Cognitive-behavioral approaches based on exposure therapy focus on the view beyond body structures.

Keywords: Adaptation psychological, Chronic pain, Exercise therapy, Fear, Musculoskeletal pain, Pain.

RESUMO

JUSTIFICATIVA E OBJETIVOS: As abordagens cognitivo-comportamentais têm sido aplicadas em pacientes com dor crônica como estratégia de tratamento para redução de sintomas e incapacidade, uma vez que o medo relacionado a dor, a cinesiofobia e a catastrofização podem representar barreiras psicossociais importantes para a recuperação. A relevância do medo e de comportamentos de evitação no desenvolvimento e manutenção de processos de dor crônica incapacitante já é bem estabelecida na literatura científica.

CONTEÚDO: A abordagem cognitivo-comportamental fundamenta a relação da dor com comportamentos de defesa e a contribuição para a incapacidade funcional, auxiliando os clínicos a reconhecer sinais destes comportamentos defensivos na prática, além de fornecer estratégias para prática clínica, destacando as abordagens que podem ser utilizadas, como a educação em neurociência da dor e as terapias de exposição. Dessa maneira, é possível fornecer um guia para facilitar a implementação desses conceitos na prática clínica para a abordagem de pessoas com dor musculoesquelética crônica, ajudando os clínicos a fundamentar as teorias de aprendizado do medo e evitação no contexto da dor e a lidar com fatores psicossociais dos pacientes que apresentam associação entre dor e movimento.

CONCLUSÃO: O medo relacionado à dor e os pensamentos catastróficos influenciam na intensidade da dor e na incapacidade funcional. O reconhecimento da dor dentro do contexto multidimensional auxilia no estabelecimento de abordagens direcionadas. As abordagens cognitivo-comportamentais baseadas em terapia de exposição têm como enfoque o olhar para além das estruturas do corpo.

Descritores: Adaptação psicológica, Dor, Dor crônica, Dor musculoesquelética, Medo, Terapia por exercício.

INTRODUCTION

Chronic pain (CP) is one of the most costly health conditions of the 21st century[1-4], as well as one that causes the most suf-

Gisele Harumi Hotta – https://orcid.org/0000-0001-5824-1737;
Anamaria Siriani de Oliveira – https://orcid.org/0000-0001-5854-0016;
Rafael Krasic Alaiti – https://orcid.org/0000-0003-1830-7011;
Felipe José Jandre dos Reis – https://orcid.org/0000-0002-1578-8422.

1. University of São Paulo, Health Sciences Department, Ribeirão Preto, SP, Brazil.
2. Grupo Superador, Department of Research, Technology and Data Science, São Paulo, SP, Brazil.
3. Federal Institute of Rio de Janeiro, Physical Therapy Department, Rio de Janeiro, RJ, Brazil.
4. Vrije University, Department of Physical Therapy, Human Physiology and Anatomy, Brussels, Belgium.

Submitted on December 23, 2021.
Accepted for publication on January 27, 2022.
Conflict of interests: none – Sponsoring sources: none.

Correspondence to:
Felipe José Jandre dos Reis
E-mail: felipe.reis@ifrj.edu.br

fering, being responsible for a negative impact on quality of life (QoL), function, physical and cognitive levels, and associated with disorders of sleep, fatigue, mood and social behavior[5]. According to international recommendations[6], CP should be considered as a disease in itself, and not a symptom or specific sign of a tissue lesion or clinical condition[7]. Considering the different factors related to the development, maintenance and exacerbation of pain, the literature has highlighted the need to recognize the experience of pain within a multidimensional context, integrating biological, psychological, social, environmental and cultural components[8]. This is the only possible manner to establish a broader and multidimensional approach to the individual with pain[9].

The influence of pain-related fear and catastrophizing thoughts on pain and disability has been highlighted in the literature. The fear-avoidance model is a predominant model that provides explanation for the interaction between pain-related fear and disability[10]. It suggests that pain may be interpreted as a threat to bodily integrity, which may lead people to prioritize pain control, resulting in a vicious cycle involving catastrophizing, hypervigilance, avoidance behavior and, in turn, disuse/disability/depression and increased pain[10-13].

The fear and avoidance model has indeed been described as a key model to explain the maintenance of maladaptive behaviors responsible for chronicity and disability in the transition from acute to chronic pain[10]. In this model, pain catastrophizing is conceptualized as an element that is cognitively relevant to interpret the threat value of pain which leads to fear and avoidance behaviors[10].

Originated in psychology, the cognitive-behavioral approaches have been applied in patients with CP as a treatment strategy for reducing symptoms, since the fear related to pain, kinesiophobia (the irrational fear of performing movements), and catastrophizing can be important psychosocial barriers for recovery[14,15]. These approaches have been highlighted as effective resources for the treatment of musculoskeletal conditions in the area of musculoskeletal physical therapy precisely because they address multidimensional aspects of pain and consider cognitive and behavioral aspects[14,15]. Recent studies have shown that exposure-based therapy is effective in reducing disability in the treatment CP patients[16-18] and have an excellent cost-effectiveness ratio, suggesting that they should be implemented in clinical practice[19].

The present study's main objectives are to describe how fear of pain, kinesiophobia and avoidance behaviors may contribute to the perpetuation of pain scenarios and contribute to chronic disability in individuals with persistent pain conditions, as well as to provide theoretical basis for the evaluation and treatment of these conditions in people with chronic musculoskeletal pain.

FEAR AND AVOIDANCE IN THE CONTEXT OF PAIN

Pain is considered a highly relevant sign because it is an indicator of the organism's integrity. Pain can be associated with the presence of a bodily injuries and, therefore, it is a strong motivator for predictive learning, that is, the ability to identify cues that precede the occurrence of pain which, in turn, favor the individual to engage in defense behaviors, anticipating the threat[12,20].

During episodes of pain, people can learn, consciously and unconsciously, to anticipate and try to control situations that are potentially harmful to the body[21]. This process is extremely adaptive, since it helps in the initial protection of the body region in pain and facilitates tissue recovery in cases in which there is, in fact, an associated injury. Nevertheless, this learning mechanism can lead to the development of persistent defense behaviors related to pain, such as fear of pain or fear of pain related to movement and avoidance behaviors[20].

Therefore, comprehending the basic concepts related to fear learning and the development and maintenance of avoidance behaviors is crucially important to better understand the possible factors associated with disability in individuals with CP, as well as to understand the potential of interventions aimed at reducing pain-related fear and avoidance behaviors in people with chronic musculoskeletal pain.

LEARNING PAIN-RELATED FEAR AND AVOIDANCE BEHAVIORS

One way in which people with pain can learn to predict harmful and threatening situations is through associative learning or Pavlovian conditioning[22]. In this type of learning, individuals quickly learn to anticipate situations related to pain implicitly by detecting stimuli that precede or occur concomitantly with pain. An example is what happens to individuals with low back pain when they see a box on the floor before they squat to pick it up. In these cases, sensory information or contextual cues, known as conditioned stimuli, that occur before or in conjunction with pain, which would be an unconditioned stimulus, start to trigger responses that previously only occurred in the presence of the unconditioned stimulus, also known as conditioned responses.

Individuals with pain can learn to have fear and other defensive neurophysiological responses such as vocalizations, muscle responses, increased sympathetic activity for contexts and sensory cues that signal possible painful situations through associative learning[23–27]. Since many musculoskeletal pain conditions are usually perceived during the performance of voluntary movements, people with pain can learn to fear and avoid movements perceived as harmful[28-33]. Limitation of these movements due to the perceived high risk of tissue damage can become a major source of disability[12,13].

Associative learning mechanisms allow fear and other defensive responses to occur in new contexts and movements different from the initial situation learned, a process known as stimulus generalization[34,35]. Stimulus generalization[28,34,36] is an adaptive learning process that allows the individual to implicitly extrapolate learning from one context (such as pain in the low back spine when lifting something off the ground) to new stimuli and contexts based on the perceptual similarity of the situations (such as bending down to tie the shoelaces), without the

need of having experienced pain in that new situation to learn how to defend oneself.

In humans, complex cognitive processes contribute to facilitate generalization to contexts or movements that lack perceptual similarity[35], but that the individual associates as potentially threatening, for example: a person with low back pain, when picking up a heavy object from the floor, may develop fear of carrying grocery bags. These findings help explain why people with pain often have fear to perform new movements that were never experienced as painful[12,28].

Another learning mechanism that may occur in individuals with pain is operant conditioning[37,38], adapted to explain the development and maintenance of defense behaviors[39] by considering the consequence of the behavior as future causes for how the individual tends to act in the future. Also, there are at least three identified manners through which operant conditioning could maintain limiting pain behaviors: direct positive reinforcement, social attention when the person manifests pain-related behaviors; negative reinforcement, such as avoiding exposure to situations that have been associated with pain; and insufficient positive reinforcement, for "good behaviors" such as lack of pleasure to perform leisure or work activities[40].

Therefore, although avoidance behaviors are sometimes produced by fear, a potent way to learn avoidance is through the consequence of behaviors performed in an attempt to minimize or control pain, such as avoiding performing a certain movement or task. When pain intensity is reduced by avoiding an activity (avoidance behavior), such behaviors can be maintained in the future even if the person no longer has symptoms when exposed to the context or performs the originally painful movement.

There is a great amount of good quality evidence supporting the validity of the fear and avoidance model in individuals with CP, with several reviews summarizing the current state of evidence[22,23,41]. There are also prospective longitudinal studies showing that fear and avoidance behaviors appear to be important factors during the process of pain chronification, in addition to being associated with chronic disability[42] and time off work[43]. Thus, the presence of fear and avoidance behaviors must be properly assessed and directed interventions to manage these factors in individuals with disabling CP must be considered.

ASSESSMENT OF PAIN-RELATED FEAR AND AVOIDANCE BEHAVIORS IN THE CLINICAL CONTEXT

Assessment of fear related to pain or movement and avoidance behaviors in people with chronic musculoskeletal pain must be done according to some key elements: patient history, identification and hierarchization of threatening activities, application of questionnaires, exposure to activities or movements considered threatening, and definition of goals with the patient[9].

During anamnesis, clinicians must use qualified listening to explore the experience of pain and its impacts on the individual's life. Thus, it is important to practice active listening and verbal and nonverbal communication strategies, avoid arguing and direct confrontation, and assist, without directing the patients to report the pain and its impacts on life from their own perspective[44,45]. This practice can assist the patient's cognitive elaboration and provides indications of factors and contexts associated with the presence of fear and other defense responses, as well as the coping strategies used.

It is important for clinicians to identify activities that are perceived as dangerous. Questions such as *"Are there any activities/movements that you believe may worsen your condition"? "Are there any activities/movements that you believe may cause some injury to your body"?* and *"Are there any activities/movements that you avoid doing because you consider them to be too dangerous for your body"?* can help the clinician to identify activities that are considered harmful and have come to be avoided.

Besides identifying the activities or movements considered threatening, it is important to establish with the patient a hierarchy of activities perceived as threatening[46]. For this, it is possible to use instruments such as the Photograph Series of Daily Activities (PHODA), a resource based on the presentation of photos to the patient, who should grade them on a scale from zero to 100, according to the perceived injury to the lumbar spine[47]. Other instruments, such as the Pictorial Fear of Activity Scale-Cervical (PFActS-C) and the Avoidance Daily Activities Photo Scale (ADAP-Shoulder)[48], follow the same principle of PHODA and were developed to evaluate avoidance in patients with cervical and shoulder pain, respectively. However, there are no photo scales developed for all musculoskeletal conditions. For these cases, the clinician can try to identify five to 10 activities by ranking the activities or movements on a scale from zero (perceived as mildly threatening) to 10 (perceived as extremely threatening).

The use of self-administered questionnaires also plays a role in the evaluation of people with pain. A number of questionnaires have been developed to assist in the assessment of pain-related fear and avoidance behaviors, such as the Fear-Avoidance Beliefs Questionnaire (FABQ)[49], Tampa Scale for Kinesiophobia[50], Pain Catastrophizing Scale (PCS)[51] and Fear of Pain Questionnaire (FOPQ)[52]. Although they provide quantitative measures that help to identify patients at higher risk of poor prognosis, these instruments do not explore the individuality of factors associated with fear in CP patients, such as dysfunctional beliefs about pain.

To do so, it is necessary to associate these instruments with therapeutic communication strategies through open-ended questions such as "What do you believe is happening with the involved body part"? followed by restatements such as "It seems that although you have stopped doing exercises to protect your involved body part, you always show improvement of symptoms after practicing them?" and a summary of what has been said by the patient such as "from what I have understood so far, your pain started when [paraphrase the patient's report"]?.

It should be noted that the assessment of maladaptive behaviors of a person with pain may not be fully revealed in the anamnesis or even after applying the scales. People with pain may say that they have no fear or avoidance of certain activities, but they may manifest defense behaviors when exposed to them[53–

[55]. Therefore, these avoidance behaviors and defense responses may arise only during exposure to the feared movements and activities in the behavioral assessment[53].

For example, it is possible that a patient presents increased sympathetic activity, observed by increased respiratory rate, increased sweating, or even measured by heart rate, or increased muscle contraction in the location of pain, causing increased stiffness and decreased movement execution speed[56] when asked to perform an activity, such as climbing a ladder, or a movement, such as bending the spine, that are considered threatening, even if the patient said he was not afraid to do it.

After identifying the main factors associated with fear and avoidance behavior, the clinician should set achievable goals with the patient. One of the ways to do that might be to ask the patient which activities or movements on the ranking list they would like to recover first or those that contribute most to their disability. This step is important for the clinician and patient to adjust expectations and work together on functional recovery. Table 1 presents some characteristics that indicate maladaptive beliefs and behaviors that may be identified during the assessment of people with chronic musculoskeletal pain.

EDUCATION AND EXPOSURE THERAPY

Treatment of patients with fear of movements/activities or avoidance behaviors is aimed at decreasing the threat value of pain and functional disability. To achieve these goals, the pain neuroscience education (PNE) and movement/activity exposure methods will be introduced, hereafter referred to simply as exposure therapy.

Different terms have been used in the literature to describe pain education for patients. The most frequent alternative terms are pain neuroscience education[57], pain biology education[58], pain neurophysiology education[59], and therapeutic neuroscience education[60]. PNE can best be described as one or more educational sessions that describe the neurobiology, the neurophysiology of pain, and the processing of pain by the nervous system[61]. PNE aims to provide more details about the neurophysiology of pain, such as peripheral receptors, peripheral and central sensitization, synaptic activity, pain modulation, and brain processing, considering the multifactorial aspects of the experience of pain[61].

The preparatory phase for exposure therapy should ensure the patient's safety when exposed to movements or activities perceived as threatening. This can be initially achieved with PNE, with the objective of preventing maladaptive responses generated by inadequate beliefs about pain. PNE has been used in CP conditions to decrease the threat value produced by the association between pain and tissue injury and, consequently, improve the patient's knowledge and favor changes in behavior[62].

In a systematic review including studies with patients with chronic musculoskeletal pain, the results showed reduction of pain intensity, disability, pain catastrophizing, and kinesiophobia in the short and medium term[63]. However, the results showed greater effects for short-term pain, medium-term disability, and short and medium-term pain catastrophizing if PNE was combined with other interventions such as exercises[63]. Thus, the use of PNE in isolation in people with chronic musculoskeletal pain is not recommended, but should be combined with exposure therapies. The different exposure therapies had their origins in psychological therapies and have been adapted for the context of pain and exercise (Table 2)[64].

The exposure therapies applied to people with chronic musculoskeletal pain aim at decreasing the disability associated with pain through the inhibition of conditioned responses acquired by the association between the conditioned stimulus, such as activity/movement, and the unconditioned stimulus, such as pain through extinction or deconditioning[15,19,65]. In extinction, when the conditioned stimuli are no longer associated with the unconditioned stimulus and the individuals notice that they no longer feel pain when performing a certain movement/activity, the conditioned responses tend to stop occurring[20].

In deconditioning, the response acquired by the association between the conditioned stimulus and the unconditioned stimulus is paired with a new unconditioned stimulus of opposite valence, for example, a pleasant sensation, such as that coming from a ludic activity, in order to not only reduce the conditioned responses, such as fear, but also to change the affective valence of the original movement or context[20].

Table 1. Characteristics that indicate maladaptive beliefs and behaviors

Characteristics	Description
Overestimation	The patient exaggerates the probability of a negative outcome and the severity of that outcome (overestimation of cost).
Intolerance to uncertainty	The patient is uncomfortable with the uncertainty of the outcome when exposing themselves to activities and movements, even if the possibility of the negative event occurring is remote.
Low coping capacity	The patient believes he or she would not be able to tolerate or cope with threatening stimuli.
Beliefs about pain	Exaggerating the significance of pain and the need to control it before exposure to any activity.
Selective attention	The patient's focus is directed only to the pain.
Selective memory and confirmation bias	The patient has a tendency to selectively recall events that reinforce their beliefs regarding pain, movement, and activity.
Safety behaviors (Avoidance)	The patient seeks to adopt behaviors designed to prevent unfavorable outcomes that somehow prevent them from being confronted with their maladaptive threat beliefs.

Table 2. Activity or movement exposure therapies

Exposure Therapy	Definition and grading
In vivo exposure	Directly confronting the threatening situation (feared movement or activity in reality). Example: the person who considers climbing a ladder to be a threatening activity can be instructed to climb a ladder.
Exposure through imagination	Vividly imagining the threatening situation or activity. Example: a person who has been injured in a sports activity, and is now afraid to do the same activity, can be asked to recall/imagine the activity in a safe situation.
Exposure through virtual reality	Virtual reality technology can be used as a form of immersion, but also when *in vivo* exposure is not the best option.
Graded activity or operant therapy	The clinician establishes feasible goals and specific behaviors with the patient, seeking a gradual return to activity. It consists of three phases: measuring functional capacity, education, and providing a submaximal exercise program that is gradually increased.
Graded exposure	The clinician helps the patient to identify a hierarchy of threatening movements/activities according to difficulty. Exposure begins with the mildest activities and progresses to moderately difficult, and finally the most difficult.
Cognition-targeted	The principles of this therapy include: (1) all exercises should be performed on a time contingent ("perform this exercise 10 times, regardless of pain") rather than pain-related contingent ("stop or adjust the exercise when you feel pain"); (2) goal setting is done with the patient, focusing on functionality rather than pain relief; (3) the clinician should continually evaluate and challenge the patient's beliefs and perceptions about pain and the predicted outcome of each exercise to change negative beliefs into positive ones; (4) exercises should be individually tailored and progressed gradually from least threatening to most threatening or complex.
Flooding	Use the threat hierarchy of activities to start exposure with the most difficult tasks.
Systematic desensitization	The exposure can be combined with relaxation exercises to make patients apprehend the possibility of control over the activities that are considered threatening.

In this way, the individuals stop presenting fear and other defensive responses when performing these activities or movements, as their expectations about pain become less threatening, consequently reducing or eliminating the avoidance behaviors that were maintained by negative reinforcement. These mechanisms help patients to have a less threatening perception of the previously feared movement and to minimize possible avoidance behaviors.

The manner through which exposure therapy will be performed depends on the nature of the musculoskeletal pain patient's threat perception, as well as their goals and objectives for treatment. Hence, when applying exercise exposure therapies, clinicians should use the hierarchy of activities/movements and the goals obtained during the assessment. Once the activity hierarchy is established, it is important for the clinician to evaluate the level of tissue sensitivity/irritability before choosing one of the exposure approaches, avoiding unnecessary exacerbation of symptoms in cases of hypersensitivity to pain.

Although patients can begin by confronting moderately threatening stimuli and gradually progress to more difficult situations, the order of this exposure may vary. Exposure can occur through imagination or through virtual reality when the threatening stimulus involves the impossibility of movement or even when the activity is impossible to be reproduced in the context of the clinical setting.

During exposure approaches, the clinician needs to help the patient to have a less threatening experience through behavioral experiments, such as helping the patient to perform the painful movement more relaxed, followed by a reassessment of the sensations, thoughts, and emotions experienced during each behavioral experiment, using questions such as "What did you feel during the movement"? or "Does doing this movement in a more relaxed manner generates a different sensation"? and by performing new exposures in different ways, such as gradually progressing the task to something that is closer to the patient's needs and goals. In any case, the objective of exposure is to engage the patient in the threatening stimulus in a systematic way, decreasing the strategies that seek defense and security, so that the patient can learn that the negative outcome of performing the movement/activity is not as likely or as severe as anticipated and that the symptoms are safe and manageable, regardless of their intensity or duration.

Each exposure cycle ends when the patient's expectations regarding the threat or intolerability of the stimulus have been contradicted to the maximum extent possible. Learning is focused on whether or not the expected negative outcome occurred, and how manageable and tolerable the patient's pain control was in relation to the activity. In some cases, this will require that exposures be prolonged and repeated several times and in different ways and contexts.

When the practice of exposure ends, patients are aided to further consolidate the newly acquired information by discussing what they learned during the experience. "*Have your fears come true?", "Were the feelings toward the activity/movement tolerable?", "What surprised you about going through the exposure"?* Patients are also assisted to recognize that regardless of how fearful they felt and how long those feelings persisted, they were able to get through the experience. Table 3 presents the steps for implementing exercise exposure strategies in clinical practice.

Table 3. Assessment and exposure therapies in practice

Assessment	
Clinical history	Qualified listening. Use verbal and non-verbal communication strategies. Consider pain as a multidimensional experience.
Identification and hierarchization of activities and movements	Identify activities/movements perceived to cause injury. Use open-ended questions. *"Are there any activities/movements that you believe may worsen your condition"?* *"Are there any activities/movements that you believe may cause some injury to your body"?* *"Are there any activities/movements that you avoid doing because you consider them to be too dangerous for your body"?* Use standardized scales. Photograph Series of Daily Activities (PHODA) Pictorial Fear of Activity Scale-Cervical (PFActS-C) Avoidance Daily Activities Photo Scale (ADAP-Shoulder) Hierarchization *Threat perception: Use a scale from zero (perceived as mildly threatening) to 10 (perceived as extremely threatening)* *Avoidance: Use a scale of 0 (I do not avoid) to 10 (I completely avoid)*
Exposure to activities or movements considered threatening	Expose patient to feared activities and movements. Observe physiological defense responses such as increased sweating and respiratory rate. Observe motor defense responses such as quality of movement.
Setting goals	Establish achievable goals. Identify the activities or movements which the patient considers most important and are limited by fear.
Therapeutic approach	
Pain education	Reduce maladaptive beliefs that increase the pain threat value and defense behaviors. Introduce concepts about the neuroscience of pain: neurons, nociception and pain, pathways, pain processing in the brain, central and peripheral sensitization. Introduce how other factors influence pain: sleep, diet, inactivity.
Define the activity or movement that will be the target of the exposure	Therapist and patient select a movement or activity from the hierarchy considering scores from zero to 4 (mildly threatening), 5 to 7 (moderately threatening), and above 7 (highly threatening).
Choose the method and grading of exposure	Described in table 2 The choice of method and grading depends on the patient and there are different recommendations for progression.
Evaluate how the patient is feeling during the exposure and challenge maladaptive beliefs	"Are you feeling safe to exercise"? "What do you think will happen when you do this exercise"? "Do you think your fear regarding this activity was really necessary"?
Provide safety cues	"Your body may be feeling pain because you are no longer used to performing these movements" "Feeling pain does not mean that your lesion is getting worse" "Exercise is important to activate circuits that inhibit pain in our body "We are doing a safe activity. Realize that if your pain increases during exercise, you may be able to manage it
Evaluate the experience	"Have your fears come true"? "Were the feelings toward the activity/movement tolerable"? "What surprised you about going through the exposure"?
Provide information about adverse events	"It is common for some people who do not exercise to feel pain the next day. This does not mean that your pain has gotten worse" "If your pain increases the next day, do lighter exercises in order to allow recovery"
Value the gains	Recognize, highlight, and value the patient's gains.

CONCLUSION

The relevance of fear and avoidance behaviors in the development and maintenance of disabling CP processes is already well established in the scientific literature. Clinicians need to recognize signs of these defensive behaviors in practice, as well as to comprehend how to address them. This article presented a theoretical framework about the association of pain with defense behaviors and the contribution to functional disability, highlighting approaches that can be used in clinical practice, such as PNE and exposure therapy, providing a guide to facilitate the implementation of these concepts in clinical practice for the approach of people with chronic musculoskeletal pain.

AUTHORS' CONTRIBUTIONS

Gisele Harumi Hotta
Preparation of the original
Anamaria Siriani de Oliveira
Project Management, Methodology, Supervision

Rafael Krasic Alaiti
Preparation of the original, Writing - Review and Editing
Felipe José Jandre dos Reis
Project Management, Methodology, Writing - Review and Editing, Supervision

REFERENCES

1. Reid KJ, Harker J, Bala MM, Truyers C, Kellen E, Bekkering GE, et al. Epidemiology of chronic non-cancer pain in Europe: Narrative review of prevalence, pain treatments and pain impact. Curr Med Res Opin. 2011;27(2):449-62.
2. Jackson T, Thomas S, Stabile V, Shotwell M, Han X, McQueen K. A systematic review and meta-analysis of the global burden of chronic pain without clear etiology in low- and middle-income countries: trends in heterogeneous data and a proposal for new assessment methods. Anesth Analg. 2016;123(3):739-48.
3. Briggs AM, Cross MJ, Hoy DG, Sànchez-Riera L, Blyth FM, Woolf AD, et al. Musculoskeletal health conditions represent a global threat to healthy aging: a report for the 2015 World Health Organization World Report on Ageing and Health. Gerontologist. 2016;56(Suppl2):S243-55.
4. Vos T, Allen C, Arora M, Barber RM, Bhutta ZA, Brown A, et al. Global, regional, and national incidence, prevalence, and years lived with disability for 310 diseases and injuries, 1990–2015: a systematic analysis for the Global Burden of Disease Study 2015. Lancet. 2016;388(10053):1545-602. Available from: https://linkinghub.elsevier.com/retrieve/pii/S0140673616316786
5. Phillips CJ. The cost and burden of chronic pain. Rev Pain. 2009;3(1):2-5.
6. Treede RD, Rief W, Barke A, Aziz Q, Bennett MI, Benoliel R, et al. A classification of chronic pain for ICD-11. Pain. 2015;156(6):1003-7.
7. Treede RD, Rief W, Barke A, Aziz Q, Bennett MI, Benoliel R, et al. Chronic pain as a symptom or a disease. Pain. 2019;160(1):19-27.
8. Ampiah PK, Hendrick P, Moffatt F, Ahenkorah J. Operationalisation of a biopsychosocial approach for the non-pharmacological management of patients with chronic musculoskeletal pain in low- and middle-income countries: a systematic review. Musculoskeletal Care. 2020;18(3):227-44.
9. Asmundson GJG, Vlaeyen JWS, Crombez G. Understanding and treating fear of pain. 2004.
10. Vlaeyen JWS, Crombez G, Linton SJ. The fear-avoidance model of pain. Pain. 2016;157(8):1599-9.
11. Vlaeyen JWS, Linton SJ. Fear-avoidance and its consequences in chronic musculoskeletal pain: a state of the art. 2000;85(3):317-32.
12. Meulders A. From fear of movement-related pain and avoidance to chronic pain disability: a state-of-the-art review. Curr Opin Behav Sci. 2019;26:130-6.
13. Crombez G, Vlaeyen JW, Heuts PH, Lysens R. Pain-related fear is more disabling than pain itself: evidence on the role of pain-related fear in chronic back pain disability. 1999;8-(1-2):329-39.
14. Leeuw M, Goossens ME, Linton SJ, Crombez G, Boersma K, Vlaeyen JW. The fear-avoidance model of musculoskeletal pain: Current state of scientific evidence. J Behav Med. 2007;30(1):77-94.
15. Asmundson GJ, Norton PJ, Norton GR. Beyond pain: the role of fear and avoidance in chronicity. Clin Psychol Rev. 1999;19(1):97-119.
16. López-de-Uralde-Villanueva I, Munõz-García D, Gil-Martínez A, Pardo-Montero J, Munõz-Plata R, Angulo-Díaz-Parrenõ S, et al. A systematic review and meta-analysis on the effectiveness of graded activity and graded exposure for chronic nonspecific low back pain. Pain Med. 2016;17(1):172-88.
17. Macedo LG, Smeets RJ, Maher CG, Latimer J, McAuley JH. Graded activity and graded exposure for persistent nonspecific low back pain: a systematic review. Phys Ther. 2010;90(6):860-79.
18. Williams AC, Eccleston C, Morley S. Psychological therapies for the management of chronic pain (excluding headache) in adults. Cochrane Database Syst Rev. 2012;(11):CD007407.
19. Goossens ME, de Kinderen RJ, Leeuw M, de Jong JR, Ruijgrok J, Evers SM, et al. Is exposure in vivo cost-effective for chronic low back pain? A trial-based economic evaluation. BMC Health Serv Res. 2015;15:549.
20. Meulders A. Fear in the context of pain: lessons learned from 100 years of fear conditioning research. Behav Res Ther. 2020;131:103635.
21. Vlaeyen JWS. Learning to predict and control harmful events: chronic pain and conditioning. Pain. 2015;156(Suppl 1):S86-93.
22. Jozefowiez J. Associative Learning. In: Encyclopedia of the Sciences of Learning. Springer US; 2012. 330-4p.
23. LeDoux JE. Coming to terms with fear. Vol. 111, Proceedings of the National Academy of Sciences of the United States of America. 2014. 2871-8.
24. Pavlov PI. Conditioned reflexes: an investigation of the physiological activity of the cerebral cortex. Ann Neurosci. 2010;17(3):136-41.
25. LeDoux J, Daw ND. Surviving threats: neural circuit and computational implications of a new taxonomy of defensive behaviour. Nat Rev Neurosci. 2018;19(5):269-82.
26. LeDoux JE, Moscarello J, Sears R, Campese V. The birth, death and resurrection of avoidance: a reconceptualization of a troubled paradigm. Mol Psychiatry. 2017;22(1):24-36.
27. Vlaeyen JWS, Crombez G. Annual review of clinical psychology behavioral conceptualization and treatment of chronic pain. 2019;16(1).
28. Pincus T, Burton AK, Vogel S, Field AP. A systematic review of psychological factors as predictors of chronicity/disability in prospective cohorts of low back pain. Spine. 2002;27(5):E109-20.
29. Harvie DS, Weermeijer JD, Olthof NA, Meulders A. Learning to predict pain: differences in people with persistent neck pain and pain-free controls. PeerJ. 2020;8:e9345.
30. Meulders A, Boddez Y, Blanco F, Van Den Houte M, Vlaeyen JWS. Reduced selective learning in patients with fibromyalgia vs healthy controls. Pain. 2018;159(7):1268-76.
31. Harvie DS, Moseley GL, Hillier SL, Meulders A. Classical conditioning differences associated with chronic pain: a systematic review. J Pain. 2017;18(8):889-98.
32. Harvie DS, Meulders A, Madden VJ, Hillier SL, Peto DK, Brinkworth R, et al. When touch predicts pain: Predictive tactile cues modulate perceived intensity of painful stimulation independent of expectancy. Scand J Pain. 2016;11-8.
33. Meulders A, Jans A, Vlaeyen JWS. Differences in pain-related fear acquisition and generalization: An experimental study comparing patients with fibromyalgia and healthy controls. Pain. 2015;156(1):108-22.
34. Meulders A, Vlaeyen JWS. Mere intention to perform painful movements elicits fear of movement-related pain: an experimental study on fear acquisition beyond actual movements. J Pain. 2013;14(4):412-23.
35. Dymond S, Dunsmoor JE, Vervliet B, Roche B, Hermans D. Fear Generalization in humans: systematic review and implications for anxiety disorder research. Behav Ther. 2015;46(5):561-82.
36. Dunsmoor JE, Murphy GL. Categories, concepts, and conditioning: How humans generalize fear. Trends Cogn Sci. 2015;19(2):73-7.
37. Rogers CR, Skinner BF. Some issues concerning the control of human behavior: a symposium. Science. 1956;124(3231):1057-66.
38. Skinner B. Science and human behavior. Pain. 1953:1134-35p.
39. Fordyce WEC, Mosby CV. Behavioral methods for chronic pain and illness. Pain. 1977;3(3):291-2.
40. Vlaeyen JWS, Crombez G. Behavioral conceptualization and treatment of chronic pain. Ann Rev Clin Psychol. 2019;7(16):187-212.
41. Keefe FJ, Rumble ME, Scipio CD, Giordano LA, Perri LM. Psychological aspects of persistent pain: Current state of the science. J Pain. 2004;5(4):195-211.
42. Lee H, Hübscher M, Moseley GL, Kamper SJ, Traeger AC, Mansell G, et al. How does pain lead to disability? A systematic review and meta-analysis of mediation studies in people with back and neck pain. Pain. 2015;156(6):988-97.
43. Jensen JN, Karpatschof B, Labriola M, Albertsen K. Do fear-avoidance beliefs play a role on the association between low back pain and sickness absence? A prospective cohort study among female health care workers. J Occup Environ Med. 2010;52(1):85-90.
44. Egnew TR. A narrative approach to healing chronic illness. Ann Fam Med. 2018;16(2):160-5.
45. Miller WR, Rollnick S. Motivational interviewing: helping people change. 3rd ed. New York, NY; 2013. 482–xii.
46. de Jong JR, Vlaeyen JWS, Onghena P, Cuypers C, den Hollander M, Ruijgrok J. Reduction of pain-related fear in complex regional pain syndrome type I: the application of graded exposure in vivo. Pain. 2005;116(3):264-75.
47. Leeuw M, Goossens ME, van Breukelen GJ, Boersma K, Vlaeyen JW. Measuring perceived harmfulness of physical activities in patients with chronic low back pain: the photograph series of daily activities-short electronic version. J Pain. 2007;8(11):840-9.
48. Ansanello W, Reis FJJ, Tozzo MC, Zatiti SCA, Meulders A, Vlaeyen JWS, et al. Development of the avoidance daily activities photo scale for patients with shoulder pain. Phys Ther. 2021;2:pzab268.
49. Abreu AM, Faria CD, Cardoso SM Teixeira-Salmela LF. Fear avoidance beliefs Questionnaire (The Brazilian version of the Fear Avoidance Beliefs Questionnaire). Cad Saude Publica. 2008;24(3):615-23.
50. de Souza FS, Marinho Cda S. Siqueira FB, Maher CG, Costa LO. Psychometric testing confirms that the Brazilian-Portuguese adaptations, the original versions of the Fear-Avoidance Beliefs Questionnaire, and the Tampa Scale of Kinesiophobia have similar measurement properties. Spine. 2008;33(9):1028-33.
51. Sardá Jr J, Nicholas MK, Pimenta CAM, Asghari A. Pain-related self-efficacy beliefs in a Brazilian chronic pain patient sample: a psychometric analysis. Stress Health. 2007;23(3):185-90.
52. Berniger Romariz JA, Nonnemacher C, Abreu M, Dickel Segabinazi J, Bandeira JS, Beltran G, et al. The fear of pain questionnaire: psychometric properties of a version for adolescents and its relationship with brain-derived neurotrophic factor (BDNF). J Pain Res. 2019;12:2487-502.
53. Caneiro JP, Bunzli S, O'Sullivan P. Beliefs about the body and pain: the critical role in musculoskeletal pain management. Braz J Phys Ther. 2021;25(1):17-29.
54. Glombiewski JA, Riecke J, Holzapfel S, Rief W, König S, Lachnit H, et al. Do patients with chronic pain show autonomic arousal when confronted with feared movements? An experimental investigation of the fear-avoidance model. Pain. 2015;156(3):547-54.
55. Caneiro JP, O'Sullivan P, Smith A, Moseley GL, Lipp OV. Implicit evaluations and physiological threat responses in people with persistent low back pain and fear of bending. Scand J Pain. 2017;17:355-66.
56. Lima M, Ferreira AS, Reis FJJ, Paes V, Meziat-Filho N. Chronic low back pain and back muscle activity during functional tasks. Gait Posture. 2018;61:250-6.
57. Malfliet A, Kregel J, Coppieters I, De Pauw R, Meeus M, Roussel N, et al. Effect of pain neuroscience education combined with cognition-targeted motor control training on chronic spinal pain a randomized clinical trial. JAMA Neurol. 2018;75(7):808-17.

58. Ryan CG, Gray HG, Newton M, Granat MH. Pain biology education and exercise classes compared to pain biology education alone for individuals with chronic low back pain: a pilot randomised controlled trial. Man Ther. 2010;15(4):382-7.
59. Clarke CL, Ryan CG, Martin DJ. Pain neurophysiology education for the management of individuals with chronic low back pain: a systematic review and meta-analysis. Man Ther. 2011;16(6):544-9.
60. Louw A, Diener I, Butler DS, Puentedura EJ. The effect of neuroscience education on pain, disability, anxiety, and stress in chronic musculoskeletal pain. Arch Phys Med Rehabil. 2011;92(12):2041-56.
61. Louw A, Zimney K, Puentedura EJ, Diener I. The efficacy of pain neuroscience education on musculoskeletal pain: a systematic review of the literature. Physiother Theory Pract. 2016;32(5):332-55.
62. Moseley GL, Butler DS. Fifteen years of explaining pain: the past, present, and future. J Pain. 2015;16(9):807-13.
63. Watson JA, Ryan CG, Cooper L, Ellington D, Whittle R, Lavender M, et al. Pain neuroscience education for adults with chronic musculoskeletal pain: a mixed-methods systematic review and meta-analysis. J Pain. 2019;20(10):1140.e1-1140.e22.
64. American Psychological Association. What is Exposure Therapy? [Internet]. APA Div. 12 (Society of Clinical Psychology). 2017. Available from: www.div12.org
65. Budtz CR, Mose S, Christiansen DH. Socio-demographic, clinical and psychological predictors of healthcare utilization among patients with musculoskeletal disorders: a prospective cohort study. BMC Health Serv Res. 2020;20(1):239.