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Literature review

Pain and movement: practical assessment methods for health and exercise professionals

Dor e movimento: métodos práticos de avaliação para profissionais da saúde e do exercício

Poliana de Jesus Santos, Lara Fabian Vieira Barbosa, José Carlos Aragão-Santos, Marcos Raphael Pereira-Monteiro, Marzo Edir Da Silva-Grigoletto

Universidade Federal de Sergipe, São Cristovão, SE, Brazil

ABSTRACT

Pain is an unpleasant experience that affects almost the entire world population at some point in life. While acute pain serves as a protective mechanism, chronic pain nega-tively impacts individuals' physical fitness, social and psychological aspects, leading to high levels of absenteeism and reduced productivity, thus becoming a global health issue. There are several treatment options for chronic pain, with physical exercise being the most recom-mended. However, to obtain the benefits of physical exercise in pain reduction, it is neces-sary to understand the factors that may be related to or interfere with the pain phenomenon. Likewise, it is essential to recognize that each individual responds differently to this phenom-enon. In this context, a detailed pain assessment is required. Proper evaluation will allow movement professionals, such as physical education instructors, physiotherapists, and other health professionals, to act more efficiently in managing pain through physical exercise. Nevertheless, pain assessment can sometimes be complex or costly, limiting its use in professional practice. Therefore, the present study seeks to present and discuss practical, low-cost methods for multidimensional pain assessment and highlight important concepts in pain management. Hence, this article will serve as a starting point for movement profession--als in managing pain through practical and cost-effective methods.

Keywords: assessment, pain; quality of life; professional competence; physical exercise

RESUMO

A dor é uma experiência desagradável que aflige quase toda a população mundial em algum momento da vida. Apesar da dor aguda servir como mecanismo de proteção, a dor crônica afeta negativamente a aptidão física, os aspectos sociais e psicológicos dos indivíduos, resultando em altos níveis de absentismo no trabalho e diminuição da produtividade, tornando-se um problema de saúde mundial. Existem várias opções de tratamento para a dor crônica e o exercício físico é a opção mais recomendada. No entanto, para a obtenção dos benefícios do exercício físico na redução da dor é preciso compreender os fatores que podem estar relacionados e/ou interferindo no fenômeno da dor. De igual forma, é essencial entender que cada indivíduo responde de uma maneira diferente a esse fenômeno. Nesse contexto, é preciso realizar uma avaliação detalhada da dor. Uma avaliação adequada permitirá aos profissionais do movimento, tais como profissionais de educação física, fisioterapeutas e outros profissionais da saúde, atuarem de forma mais eficiente no manejo da dor por meio do exercício físico. Contudo, por vezes a avaliação da dor pode ser muito complexa ou de alto custo dificultando sua utilização na prática profissional. Portanto, o presente estudo busca apresentar e discutir métodos práticos e de baixo custo para a avaliação da dor de modo multidimensional, bem como destacar conceitos importantes no tratamento da dor. Desta forma, esse artigo será um ponto de partida para a atuação dos profissionais do movimento no manejo da dor por meio de métodos práticos e de baixo custo.

Palavras-chave: avaliação, dor; qualidade de vida; competência profissional; exercício físico

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Correspondence: Poliana de Jesus Santos, polianadejsantos@gmail.com

Introduction

The International Association for the Study of Pain (IASP) defines pain as "an unpleasant sensory and emotional experience associated with, or resembling that associated with, actual or potential tissue damage" [1]. Pain can be temporally classified as either acute or chronic. Chronic pain is defined as pain persisting for more than three months beyond the typical healing time for an injury or associated with chronic pathological processes that result in continuous or recurrent pain. Studies indicate that the global prevalence of chronic pain is 53% [2], and in Brazil, this prevalence stands at 45.59%, with the lower back being the most affected area [3].

Chronic pain impacts not only physical fitness but also social and psychological aspects of an individual's life. Among people reporting chronic pain, high levels of work absenteeism and decreased productivity have been observed [4]. Given the high prevalence of chronic pain, it is reasonable to expect significant economic repercussions. Furthermore, individuals with chronic pain have been found to be twice as likely to report suicidal behaviors or to die by suicide [5], underscoring the impact of chronic pain on mental health. Despite these consequences, pain is often overlooked in the context of assessing an individual's health status. Nevertheless, certain interventions can provide a better experience for those suffering from pain-related distress, facilitating decision-making and leading to improved outcomes [6].

However, some movement professionals still seem to underestimate the impact of pain when interacting with clients and patients. This may be due to factors such as a lack of knowledge about pain assessment methods [7] and the normalization of pain during physical exercise. This tendency to normalize pain, along with the lack of professional conduct adjustments in response to this condition, results in decreased engagement with these professionals among individuals suffering from chronic pain [8]. Consequently, this leads to a lack of awareness of the beneficial effects of physical exercise on pain management among some of these professionals. Interestingly, the same professionals who sometimes normalize pain are also responsible for one of the most scientifically supported non-pharmacological interventions for pain reduction: physical exercise [9-11].

For movement professionals to effectively promote health and reduce pain through exercise, it is essential to conduct a holistic assessment of the condition of the client or patient, including pain assessment to guide professional conduct and provide indicators for medium- and long-term follow-up [12]. Immediately, pain assessment can help to identify movement patterns that the client or patient may alter or even avoid due to pain. Additionally, baseline assessment values enable the professional to monitor whether pain increases or decreases in response to the adopted approach. In cases where pain worsens, a "fear-avoidance" cycle often occurs, leading to the cessation of exercise due to past painful experiences, which may foster limiting beliefs [13].

Despite the challenges discussed, exercise remains the primary approach for treating chronic pain [14] and is also the main tool used by movement professionals. Mechanisms such as exercise-induced hypoalgesia reduce pain intensity and enhance the quality of life for individuals with chronic pain [15]. However, studies show that participants in various exercise modalities — such as Pilates, weight training, martial arts, CrossFit, body jump, and others — who are guided by movement professionals exhibit high rates of pain incidence, regardless of regular exercise practice [16-19]. This may stem from underlying biomechanical or social factors that are inadequately assessed. Thus, it becomes necessary for these professionals to incorporate pain assessment in their approach. This ensures that regular physical exercise promotes pain reduction and encourages individuals to see exercise as an effective approach to pain management, alongside its numerous health benefits.

Considering the impact of chronic pain, the potential of physical exercise in its treatment, and the limited use of pain assessment methods among movement professionals, this study aims to present and discuss practical, low-cost methods for multidimensional pain assessment tailored to movement professionals. Additionally, it highlights pain-related concepts and mechanisms, consolidating existing literature into an accessible, reader-friendly narrative review

Pain mechanisms

Pain is a response to noxious stimuli that threaten tissues or the organism's survival, alerting the body to protect the tissue from damage. These noxious stimuli typically stem from extreme pressure and/or temperatures, potentially resulting in tissue damage. Pain pathways form a complex and dynamic system encompassing sensory, cognitive, and behavioral aspects [20].

The noxious stimulus is initially detected by peripheral neurons called nociceptors, which transmit the nociceptive stimulus to the central nervous system (CNS) [21]. Pain-related nerve fibers are classified into two types: Aδ and C fibers. Aδ fibers are larger in diameter and myelinated, resulting in faster conduction speeds and typically associated with acute or sharp pain. Conversely, C fibers have slower conduction speeds, smaller diameters, and are unmyelinated associating them more with prolonged nociceptive stimuli, as in cases of chronic pain [21, 22].

Among the ascending pain pathways, the spinothalamic pathway stands out for its role in the sensory-discriminative aspects of the pain experience, including the identification of location, intensity, and type of pain stimulus. Meanwhile, the spinoreticular pathway, connected to the amygdala, is associated with more diffuse pain and the affective properties of pain [23]. These pathways are vertically located along the ventrolateral portion of the spinal cord and transmit pain, temperature, and deep pressure stimuli to the thalamus [24]. Once reaching the thalamus, the nociceptive stimulus is directed to other brain areas, such as the cortex, for processing, which results in pain perception [25].

After processing a painful stimulus, the brain can modulate pain through descending mechanisms, producing an analgesic effect during the pain process. In the gray matter region of the brain, a pain inhibition system is activated via its connection with the ventromedial nucleus of the spinal cord, a process mediated by opioids. This structure is involved in both pain inhibition and facilitation [26]. Literature suggests that an imbalance between the ascending and descending pain pathways may lead to a pathological and continuous pain process, initiating chronic pain [27].

Another mechanism related to the pain experience is temporal summation (TS), which mainly affects C fibers. TS increases the activity of second-order neuron receptors, resulting in increased pain, particularly present in cases of chronic pain [28]. TS is thought to be part of a phenomenon known as central sensitization (CS), leading to hyperalgesia (increased pain intensity in response to a noxious stimulus) and allodynia (pain in response to a non-painful stimulus), which exacerbate pain perception [29].

Pain not only induces changes in neurons communicating with the thalamus but also in neurons projecting from the amygdala to the medial prefrontal cortex, related to cognitive and emotional processes [30]. Thus, the pain experience impacts not only the sensory-discriminative dimension but also the affective-motivational dimension. Within this context, chronic pain patients often exhibit pain catastrophizing, reduced self-efficacy, and depression. Pain catastrophizing is defined as an exaggerated negative orientation towards current or anticipated painful experiences, encompassing feelings of helplessness related to pain, and is a risk factor for the development of chronic pain [31].

Furthermore, a factor that can either positively or negatively influence the pain experience is self-efficacy — the belief that one can successfully perform a task or achieve a favorable outcome. Self-efficacy is one of the main determinants of how a person with chronic pain will manage their pain, potentially affecting their adherence to different forms of treatment depending on its level [31]. Additionally, it is worth noting that participant experience plays a crucial role in adherence to regular exercise; thus, enjoyment is linked to greater participation and the effectiveness of physical exercise, while unpleasant experiences negatively impact exercise adherence and participation [32].

Moreover, studies indicate that 40-50% of individuals with chronic pain also suffer from depression [33], as chronic pain can be a stress factor that induces depression or exacerbates the processes involved in the progression of the disease. Individuals who develop both conditions simultaneously often face a poor prognosis [33].

Pain assessment

Conducting a detailed pain assessment is essential for guiding professional conduct during pain treatment and for prescribing physical exercise effectively, aiming to prevent the onset of pain during intervention. To achieve this, it is crucial to select appropriate tools for assessing pain based on the specific situation, as well as the specificity and information each instrument provides [33]. Quantitative sensory testing (QST) can be employed, which assigns numerical values to the observed phenomenon — in this case, pain — using simple tools such as an algometer, a sphygmomanometer, and a stopwatch. Among the tests highlighted in the literature are pressure pain threshold (PPT), temporal summation (TS), conditioned pain modulation (CPM), and tactile detection threshold (TDT). Together, these tests form a method for assessing CS, which is commonly present in chronic pain patients [34].

Additionally, pain can be assessed using scales such as the Numerical Pain Rating Scale (NPRS), the Visual Analog Scale (VAS), and the Pain Catastrophizing Scale (PCS), which are practical and quick to administer. Questionnaires like the McGill Pain Questionnaire (MPQ), the Brief Pain Inventory - Short Form (BPI-SF), and the Pain Self-Efficacy Questionnaire (PSEQ-10) can also be used to gather more detailed insights about the pain experience.

The PPT assesses the minimum pressure applied to a body area necessary to elicit a painful or uncomfortable sensation. This test evaluates the nociceptive threshold of free nerve endings in the sensory neurons located in the dorsal horn of the spinal cord [35]. Studies indicate that individuals with chronic pain generally have a lower pain threshold compared to healthy individuals, which can be considered a factor related to CS [36] (Figure 1A). The PPT can be evaluated near the affected area or in a distant region from the pain focus. For assessing PPT in the lumbar region, a digital pressure algometer with a 1 cm^2 area is used, bilaterally 5 cm laterally from the spinous processes of the third (L3) and fifth (L5) lumbar vertebrae [37].

Another measure of quantitative sensory testing is the TS which assesses the excitability of type C fibers in the dorsal horn of the spinal cord when painful stimulation is applied [38]. The main characteristic of TS is the increase in pain perception with repeated painful stimulation [39]. For this test, a persistent painful stimulus is applied using a pressure algometer at a constant pressure of 4 kg/cm^2 on an area of the body, usually the forearm or thenar region, for 30 seconds. During this period, pain intensity is assessed at four different time points (1st, 10th, 20th, and 30th seconds) using a numerical pain scale (0-10). Significant discrepancies in values are an indicator that pain is summing in this individual rather than habituating to the stimulus, a feature often present in populations with chronic pain due to CS [40] (Figure 1B).

CPM is described as the phenomenon where "one pain inhibits another pain". The CPM assesses the nervous system's ability to reduce pain sensation when another painful stimulus is applied at a distant site. When the pain control system functions correctly, the second painful stimulus, known as the conditioning stimulus, reduces the pain of the first painful stimulus [41]. It is worth noting that CPM and TS are complementary, as they assess, respectively, the descending and ascending pain pathways.

To assess CPM, the PPT is first evaluated in a specific area, possibly the same area where TS was assessed. A second painful stimulus (conditioning) is applied at another location, which may involve pressure (e.g., using a sphygmomanometer) or a thermal stimulus (e.g., cold water), until the stimulus is perceived with an intensity greater than 4 on the NPRS. During the application of the conditioning stimulus, the PPT is reassessed at the same site evaluated earlier. Five minutes after the removal of the conditioning stimulus, the PPT is reassessed [34]. An increase in PPT during the second and third measurements indicates pain modulation reduction, suggesting that descending pain pathways are activated and capable of decreasing pain intensity (Figure 1C). For further guidance on performing these tests, access the video.

Click or scan to watch

Figure 1 - 1A: Assessment of PPT, performed bilaterally 5 cm from the spinous processes of L3 and L5. 1B: Assessment of TS of pain in the dominant arm of the volunteer, 7.5 cm above the wrist line. 1C: Evaluation of CPM, using ischemic compression as the conditioned stimulus via a sphygmomanometer. The PPT was assessed at the same location as the temporal summation, 7.5 cm above the wrist line

The TDT is used to identify signs of hyperalgesia and allodynia, conditions commonly found in individuals with CS [42]. To perform this test, a set of six monofilaments, all made of nylon and each with a different diameter and weight, is used. The filaments progressively increase in pressure applied to the skin. If a filament that does not normally induce pain elicits a painful response in the individual, it is likely that the person has allodynia. Furthermore, if one of the filaments used as a mild painful stimulus induces a pain intensity greater than what is expected, this may be a sign of hyperalgesia [43].

It is important to note that the performance of quantitative sensory tests is done using devices such as a pressure algometer, Semmes-Weinstein monofilaments, and a sphygmomanometer. These devices are widely available for purchase by professionals, and they are generally more affordable compared to other research equipment. An example of a device that requires greater financial investment is the computerized pressure algometry. The choice of equipment depends on the professional's available budget and desired investment, as both digital and computerized algometers provide reliable evaluation results.

In addition to quantitative sensory testing, pain can be assessed using the NPRS and the VAS, both of which evaluate an individual's subjective pain perception [44]. For the NPRS, a ruler divided into eleven equal parts (ranging from zero to ten) is used, where the patient matches their pain intensity to a corresponding number, with zero representing no pain and ten representing the maximum pain [45]. The VAS is similar but does not involve specific numbers; instead, the patient is asked to mark a point on a 10 cm line, where 0 represents no pain and 10 represents the worst possible pain. A ruler is then used to measure the exact point marked by the patient [46]. Both scales are easy to understand and require minimal resources for use. These tools allow for an understanding of pain intensity in an individual and can be used to assess pain tolerance during exercise, as well as monitor progress over time for those being evaluated [46].

Pain scales and their variations have been validated in Brazil for use in various populations [46]. For example, the VAS gave rise to the Faces Pain Scale, which is used to improve understanding for specific populations, such as children, adolescents, older people, people with hearing impairments, and aphasic individuals. When used with children, the scale includes drawings of characters from well-known programs [47]. For older people, adaptations are also made using concepts that are easier to understand in cases of cognitive impairment related to aging [48]. Figure 2 shows the variations of pain scales.

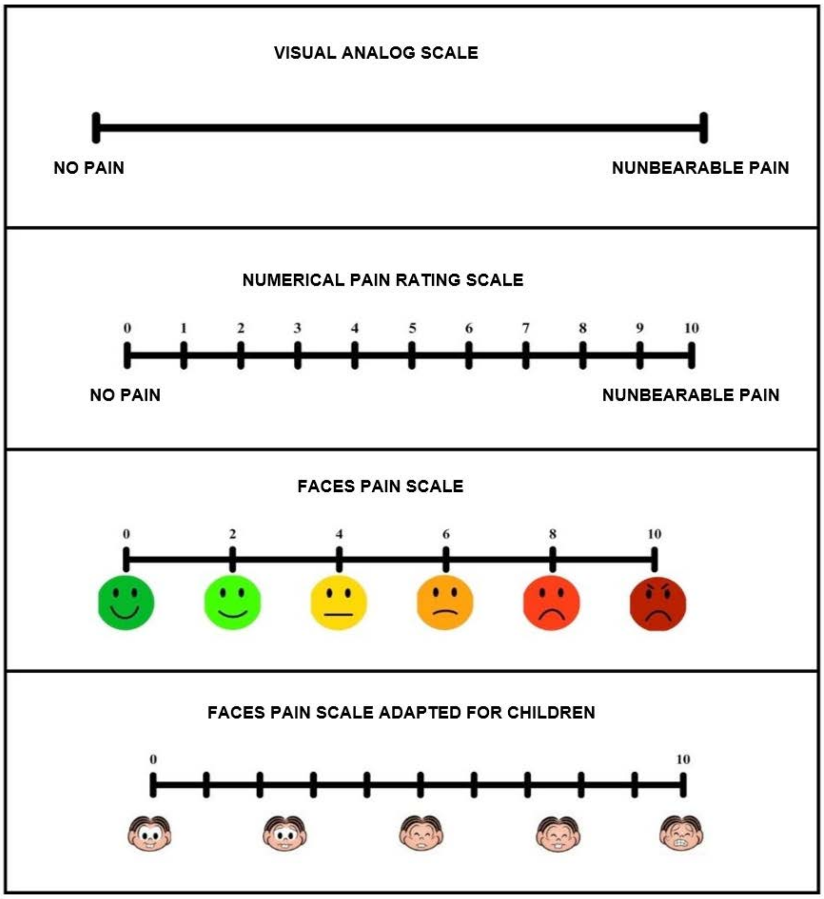

Figure 2 - Pain Scales

Another way to assess individuals suffering from pain is through questionnaires, which can be directly related to pain or psychosocial problems associated with the chronicity of pain. A well-known questionnaire for pain assessment is the MPQ, which focuses on the context and characterization of pain, addressing sensory and affective aspects. This questionnaire has a broad range of application and can be used for both chronic and acute pain in various conditions where pain is a symptom [49]. The MPQ is subdivided into four subscales that assess the sensory, affective/evaluative, and miscellaneous aspects of pain. Responses are given on a scale from: (0) none, (1) mild, (2) discomforting, (3) distressing, (4) horrible, and (5) excruciating [50].

Similar to the MPQ, the pain severity subscale of the BPI-SF directly assesses the interference and intensity of pain and can also be used in various situations. It consists of four 11-point numeric pain scales: two assess the worst and least pain experienced in the last 24 hours, and the other two assess the average and current pain at the time of the evaluation [51].

Another questionnaire that can be used is the Central Sensitization Inventory (CSI), which indicates the presence of symptoms associated with CS through a self--perception scale. In this context, other factors related to CS, such as catastrophizing and self-efficacy, can also be assessed through the Pain Catastrophizing Scale (PCS) and the PSEQ-10, respectively. It is important to note that these latter measures enable a psychosocial evaluation of this population [52].

Furthermore, when discussing pain, another important factor that is highly affected in this population is quality of life. Quality of life can be assessed using the European Quality of Life-5 Dimensions (EQ-5D) questionnaire, which evaluates the quality of life across five dimensions: mobility, self-care, usual activities, anxiety/depression, and pain/discomfort. The last dimension specifically evaluates the impact of pain on quality of life. EQ-5D results can be classified according to the severity level [53]. Additionally, there are specific questionnaires for evaluating the quality of life in individuals with chronic pain, such as the Short Form Health Survey 36 (SF-36), which assesses the multidimensional aspects of pain's impact on this population [53].

Thus, we believe that the use of these tests, scales, and questionnaires provides a comprehensive view of the health status of the individual being assessed, helping to guide the treatment plan and track the progress of the patient/client beyond commonly known aspects such as strength, hypertrophy, and range of motion. The evolution of pain and how it affects other socioemotional domains is an important aspect to monitor, as it significantly contributes to the well-being and quality of life of individuals. Table I summarizes the main instruments used for pain assessment by movement professionals.

Table I - Pain Assessment instruments

Assessment methods		Brief summary of what it assesses	Required materials	Average time needed	Advantages	Disadvantages
Physical test	PPT	Nociceptive threshold of free nerve endings	Algometer	Less than 1 minute	Quick and easy to perform	Requires a pressure algometer
	TS	Excitability level of C-fibers	Algometer stopwatch	Less than 1 minute	Quick and easy to perform	Requires a pressure algometer and stopwatch
	CPM	Nercous system's ability to reduce pain sensation when another painful stimulus is aplied at a distant area	Algometer, sphygmomanometer, or ice bucket and stopwatch	Around 8 minutes	Quick and easy to perform	Requires a pressure algometer, sphygmomanometer, and stopwatch
	TDT	Presence of signs of hyperalgesia or allodynia	Semmes-Weinstein monofilaments	Around 8 minutes	Quick and easy to perform	Requires Semmes-Weinstein monofilaments
Scales	NPRS	Subjective pain perception	Paper, ruler, pen	Less than 1 minute	Very quick to perform and does not require expensive equipment	Subjective assessment
	VAS	Subjective pain perception	Paper, ruler, pen	Less than 1 minute	Very quick to perform and does not require expensive equipment	Subjective assessment
	PCS	Pain catastrophizing	Printed questionnaire and pen	Around 10 minutes	Easy and quick to perform	Understanding how to interpret the questionnaire results
Questionnaires	MQP	Characterization of pain addressing sensory and affective aspects	Printed questionnaire and pen	Around 15 minutes	Identifies more aspects related to pain	Depending on educational level, the respondent may have difficulty understanding the questions
	BPI- SF	Pain interference and intensity	Printed questionnaire and pen	Around 5 minutes	Easy and quick to perform	Subjective assessment
	PSEQ-10	Self-efficacy	Printed questionnaire and pen	Around 10 minutes	Easy and quick to perform	Depending on educational level, the respondent may have difficulty understanding the questions

PPT = pressure pain threshold; TS = temporal summation; CPM = conditioned pain modulation; TDT = tactile detection threshold; NPRS = Numerical Pain Rating Scale; VAS = visual analog scale; PCS = pain catastrophizing scale; MPQ = McGill pain questionnaire; BPI-SF = brief pain inventory – short form. PSEQ-10 = pain self-efficacy questionnaire

Final considerations

Pain assessment by movement professionals is highly valuable in clinical and practical contexts, including gyms, studios, and clinics, as individuals in these settings are often afflicted by pain, whether chronic or acute. Understanding the importance of pain assessment, the tools available, and their proper application enables professionals to conduct thorough evaluations and prevent pain from hindering clients' performance when pain is not the treatment focus. This can help shift the perspective, viewing exercise not as something that causes pain, but as something that reduces it.

Conflict of interest
No potential conflict of interest relevant to this article was reported

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Conception and design of the research: Da Silva-Grigoletto ME, Santos PJ; Acquisition of data: Barbosa LFV; Writing of the manuscript: Barbosa LFV, Santos PJ, Aragão-Santos JC, Pereira-Monteiro MR; Critical revision of the manuscript for important intellectual content: Da Silva-Grigoletto ME

Glossary

Hypoalgesia - Reduction in sensitivity to pain.
Hyperalgesia - Increased sensitivity to pain.
Noxious stimuli - Stimuli that have the potential to cause tissue damage or evoke the sensation of pain.
Nociceptors - Sensory receptors located in the skin that are specialized in detecting noxious stimuli and transmitting pain signals to the central nervous system.
Myelinated - Refers to nerve fibers that are surrounded by a myelin sheath, which increases the speed of nerve signal transmission.
Unmyelinated - Nerve fibers that lack a myelin sheath, resulting in slower transmission of nerve signals.
Temporal summation - A process in which repetitive and continuous stimuli gradually increase the perception of pain, even if the stimulus itself does not intensify.
Central sensitization - Increased responsiveness of neurons in the central nervous system following repetitive or intense stimulation, leading to an exaggerated perception of pain.
Allodynia - Pain caused by stimuli that do not normally provoke pain, such as light touch on the skin.
Sensory-discriminative dimension- The aspect of pain experience that allows for identification of the location, intensity, and type of the painful stimulus.
Affective-motivational dimension- The aspect of pain experience related to the emotional and motivational responses it triggers, such as distress or the desire to avoid pain.

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