



Pain Catastrophizing and Attentional Bias among Patients with Chronic Back Pain in Isfahan, Iran: A Comparative Study

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Quantitative Study

Abstract

Background: Chronic back pain accounts for 70 to 85% of all kinds of chronic pain. Chronic back pain is recognized as the third most common disease among Iranians aged between 15 and 69 years. According to previous studies, psychological aspects of pain perception are the main reason for referral to clinics. Therefore, the understanding of creating and continuing factors, such as psychological parameters, is necessary for recognizing the procedure affecting the alleviation of disease in its initial stages. This, in turn, leads to preventing the long-term consequences of chronic back pain. This study aimed to compare pain catastrophizing and attentional bias between patients with chronic back pain and healthy individuals in Isfahan, Iran.

Methods: This was a descriptive-analytical study in which 34 patients with chronic back pain and 33 healthy individuals were investigated and compared. All participants completed the Pain Catastrophizing Scale (PCS) and attentional bias was assessed using the dot-probe task.

Results: The average age of participants was 39.40 years \pm 9.79, and 38.8% of them were men. Based on the present study findings, there was a significant difference in pain catastrophizing between patients with chronic back pain and the control group. Moreover, the results of attentional bias of the two groups in the incongruent situation of the dot-probe task were significantly different.

Conclusion: This study showed that there was a significant difference in pain catastrophizing and attentional bias between patients with chronic back pain and controls. Furthermore, people with chronic back pain presented attention avoidance.

Keywords: Pain, Chronic pain, Attentional bias, Pain catastrophizing

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Introduction

The International Association for the Study of

Pain (IASP) defines pain as an unpleasant emotional experience which arises from real or possible tissue damage. Pain is a mental experience that may be accompanied with a variety of symptoms and emotional disturbances, in particular mood and anxiety disorders, because of the unpleasant sensual

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and emotional components of pain.

These unpleasant emotional experiences are rooted in psychological causes. There is no formal way of recognizing tissue damage; therefore, these mental experiences, which are based on individuals' report, are considered as pain (Childs et al., 2008).

Back pain is pain felt from the margin to the groin. According to its duration, back pain can be defined as acute (less than 4 weeks), sub-acute (between 4 weeks and 3 months), or chronic (more than 3 months) (Frymoyer, 1988).

Back pain is one of the most common diseases in developed and developing countries with a 70 to 80% prevalence among the mature population. In 10 to 20% of cases with back pain, pain can be transformed into chronic pain (Carey, Garrett, & Jackman, 2000). Patients with chronic back pain make up 73 to 77% of the population with back disabilities, 85% of whom have no real reason for their pain (Indahl, Velund, & Reikeraas, 1995; Coste, Delecoeuillerie, Cohen de, Parc, & Paolaggi, 1994). Chronic back pain accounts for 70 to 85% of all kinds of chronic pain (Hansen, Daykin, & Lamb., 2010).

Based on the years of disability, the prevalence rate of debilitating back pain is 2.1%. Regardless of intentional and inadvertent damage, chronic back pain is recognized as the third most common disease among Iranians aged between 15 and 69 years (Mousavi et al., 2011)

In most cases, the psychological aspects of pain perception are the main reason for patients' referral to clinics. Psychological aspects impact chronic reactions to pain and interfere with the daily life of individuals (Nicholas Asghari, & Blyth, 2008). Even patients with similar risk factors and clinical status show a significant difference in physical and psychological disabilities (Jensen, Keefe, Lefebvre, Romano, & Turner, 2003).

Experimental evidence reveals that psychological factors have a stronger correlation with general disabilities compared to other parameters (Sharpe, 2014;

Koleck, Mazaux, Rascle, & Bruchon-Schweitzer, 2006). Chronic pain is usually associated with other disorders like depression (Miller & Cano, 2009), anxiety (Asmundson & Katz, 2009), disability (Tripp, VanDenKerkhof, & McAlister, 2006), lower quality of life (QOL) (Dillie, Fleming, Mundt, & French, 2008) and defective social relations (Turk et al., 2008). Hence, the recognition of creating and continuing factors such as psychological, biological, and social parameters are necessary (Fashler & Katz, 2014).

In patients suffering from chronic pain, the main focus is on reducing symptoms and stabilizing functional status. Therefore, the understanding of mechanisms involved in the progress of disease at early stages is valuable, which can predict unpleasant long-term consequences in patients or even prevent them from happening (Evers, Kraaijaat, Geenen, Jacobs, & Bijlsma, 2003).

The duration and severity of pain are unpredictable and there is no direct relation between them and the amount of damage or the type of treatment (Lee, Chronister, & Bishop, 2008).

The fear-avoidance model of pain has been developed as a result of the increased risk of physical disability in patients with chronic back pain (Vlaeyen & Linton, 2000). If severe pain is interpreted mistakenly as a threat factor, it can result in pain catastrophizing, characterized by helplessness, mental rumination, and the magnification of symptoms (Sullivan et al., 2001). Catastrophe beliefs exacerbate disability in patients by drawing permanent focus toward body signs and preventive activities (Evers et al., 2003).

Recently, it has been proved that, in addition to psychological parameters, attention factors play a vital role in pain perception (Vlaeyen & Linton, 2000; Pincus & Morley, 2001; Eccleston & Crombez, 1999). According to the study carried out by Todd, Sharpe, Johnson, Nicholson, Colagiuri, & Dear (2015), attentional bias affects the mechanisms of interpreting chronic pain.

Attentional bias is the cognitive bias that refers to the tendency of individuals towards the way of interpreting environmental stimuli (Pincus & Morley, 2001).

Attentional bias is characterized as an increase in hypervigilance or a decrease in attention toward a specific group of stimuli (Keogh, Thompson, & Hannent, 2003). Some previous researches have reported attentional bias in patients with chronic pain, but some others have reported avoidance of attentional bias (Pincus & Morley, 2001; Crombez, Heathcote, & Fox, 2015; Dear, Sharpe, Nicholas, & Refshauge, 2011; Haggman, Sharpe, Nicholas, & Refshauge, 2010).

It has been showed that there is bias in the attention of patients with chronic back pain compared with controls (Crombez, Heathcote, & Fox, 2015; Franklin, Holmes, Smith, & Fowler, 2016; Baum, Huber, Schneider, & Lautenbacher, 2011; Schoth, Nunes, & Lioffi, 2012). Moreover, it has been experimentally observed that attentional bias leads to an increase in the activity of brain regions which are involved in attention (Taylor et al., 2016). Furthermore, the results of the research done by Lioffi, White, and Schoth (2011) demonstrated that there is no significant difference in attentional bias between patients and controls.

In general, it has been proved that psychological parameters are connected with arising, developing, and persistence of chronic pain (Gatchel, Peng, Peters, Fuchs, & Turk, 2007). The better understanding of the processes of attention toward pain stimuli compared with the healthy group could be helpful for the diagnosis and management of pain (Taylor et al., 2016). Woud, Zhang, Becker, Zlomuzica, and Margraf (2016) declared that from among physical symptoms, catastrophizing maladaptive interpretation can result in psychosomatic symptoms like somatoform pain. Pain catastrophizing is responsible for transforming post-surgery pain into chronic pain (Khan et al., 2011).

A low muscular endurance in the back in

patients with chronic pain is related to pain catastrophizing (Lariviere, Bilodeau, Forget, Vadeboncoeur, & Mecheri, 2010) which can have impact on the severity of musculoskeletal pain (Meyer, Tschopp, Sprott, & Mannion, 2009; Linton et al., 2011; Richardson, Ness, Doleys, Banos, Cianfrini, & Richards, 2009; Wideman, Adams, & Sullivan, 2009). However, Fashler and Katz (2014) found no significant difference in pain catastrophizing between patients and controls.

As was mentioned, psychological parameters play important role in transforming an acute pain into chronic pain in patients with chronic back pain. Since there are many contradictions with respect to the results of pain catastrophizing and attentional bias in patients with chronic back pain, the present study was conducted to compare these parameters between patients with chronic back pain and healthy people by focusing on the attentional bias model.

Methods

This descriptive-analytical study was conducted on patients with chronic back pain referred to a neurosurgeon in Isfahan (Iran) during July and August of 2017. The study inclusion criteria were ages of 19-59 years and confirmed chronic back pain (experiencing pain for at least 3 months in the past 6 months), ability to complete the questionnaires through self-report or interview, ability to perform the dot-probe task (lack of mental and physical disability, lack of intake of medicine that affect the central nervous system), and informed consent for participating in the study.

This study was approved by the Ethics Committee of Azad University of Khorasgan, Isfahan, and verbal consent was obtained from all patients.

All participants completed the Pain Catastrophizing Scale (PCS), and attentional bias was assessed through a dot-probe task. After being diagnosed by a specialist, patients were referred to trained interviewers, filled out the self-administered

questionnaires, and were assessed using the dot-probe task software.

At first, patients were examined. After matching the two groups in terms of demographic characteristics (including gender, age, and educational level), the controls were selected from an educational institute in Isfahan city during September of 2017.

The subjects of this study were 41 woman and 26 men. The sampling method used was convenience sampling method. The average age of the participants was 39.40 ± 9.79 years, and 38.8% of them were men.

The dot-probe task software was designed by the researcher based on the theoretical model of the dot-probe task. The word images used in this study were obtained from the research performed by Asmundson and Katz (2009). In this task, both emotional pictures and emotional words about pain can be used. However, the use of emotional words instead of emotional pictures is suggested (Asmundson & Katz, 2009). In this study, the dot-probe-task software was designed using visual basic programming language and MATLAB (MathWorks, Natick, MA, USA).

We used the modified version of the dot-probe task in which the order of showing stimuli was as presented below:

In the first step, the program showed a fixed point in the middle of the screen for 200 milliseconds. Then, the fixed point disappeared and two images were shown at the top and bottom of the screen, one of which had emotional meaning related to pain experience and the other one had a neutral meaning.

The images and their positions were randomly chosen. After 300 ms, images disappeared and the fixed point reappeared simultaneously in the middle of the screen.

After 100 ms, the fixed point disappeared and one arrow appeared at the top or bottom of the screen the direction of which would change from right to left accidentally. The position of the arrow was exactly the same as the words.

Participants were asked to press the keyboard key corresponding to the direction of

the arrow they had seen at the minimum time possible. The maximum time given was 1500 ms. After that, the task was repeated from the first step. After the arrow appeared, the answering time for the participants started. The important factor was the reaction speed of each individual. The participants were given the opportunity to do 5 practices in order to see if there were any ambiguities for them. Then, they were assessed by the main task.

The appearing time settings were arranged based on the time needed for saccade and decision-making (Fischer & Weber, 1993). One of the most important factors in time settings was the time interval between the three phases, including showing the fixed point, showing the words, and showing the arrow. In order to prevent the eye movement toward the first point on the screen, the time of showing the fixed point was 100 ms which was shorter than the time needed for saccade (Fischer & Weber, 1993). The fixed point was a black point in 64 pixels and appeared exactly in the middle of the screen.

The size of the word pictures was 350*350 pixels and were placed 50 millimeters (mm) lower and higher than the fixed point position.

The background of the screen was white. The time strings are shown in figure 1.

The PCS is one of the most commonly applied and well-validated questionnaires for the assessment of catastrophizing thoughts and behaviors regarding pain (Sullivan et al., 2001). The PCS contains 13 items scored on a 5-point scale (0 to 4) and covers 3 dimensions of pain catastrophizing, including rumination, helplessness, and magnification. These three scales evaluate negative thoughts related to pain.

Participants were asked to choose one number between 0 (never) and 4 (always) to determine the frequency of 13 different situations related to painful experiences. The linguistically validated and reliable Persian version of the PCS was used in this study (Davoudi, Zargar, Mozaffaripour, Nargesi, & Molah, 2012).

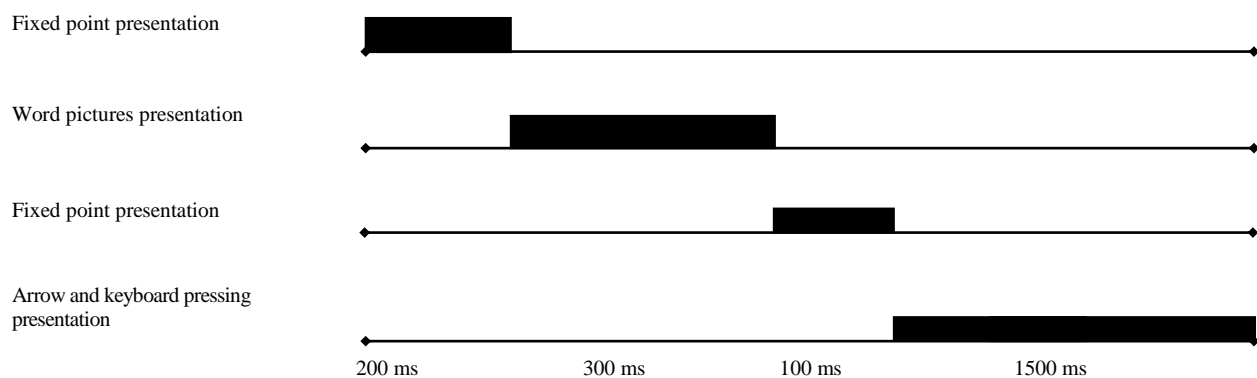


Figure 1. The order of presentation and timing in the dot-probe task

An interviewer was available if the patients required an explanation for completing the questionnaire.

In a study on patients with musculoskeletal pain, this scale was found to have acceptable reliability (Cronbach's alpha = 0.92) (Meyer et al., 2009). The correlation coefficient between PCS and the Beck Depression Inventory for Primary Care (BDI-PC) has been calculated in Iran. The results showed that there was a significant positive correlation between PCS and BDI-PC ($r = 0.46$) (Davoudi et al., 2012).

In this study, the K-alpha coefficient for PCS was 0.77 that was an acceptable reliability.

Results

Type 1 error probability and power were considered as 0.05 and 0.95, respectively. Data were analyzed in the SPSS software (version 20, SPSS Inc., IBM Corporation, Armonk, NY, USA). Quantitative data were presented as mean and standard deviation [Mean \pm SD ($n = 67$)] and qualitative data were presented as percentage. Statistical comparisons were made using independent sample t-test.

The study participants consisted of 34 patients with chronic back pain and 33 healthy individuals. The average age of the participants in the patient group was

39.61 ± 9.36 years and that of the controls was 39.27 ± 10.35 years.

Table 1 shows mean and standard deviation of pain catastrophizing themes.

Table 1. Mean and standard deviation of pain catastrophizing themes

Subscales	Patients group	Healthy individuals group
	Mean \pm SD	Mean \pm SD
Helplessness	6.76 ± 5.08	4.06 ± 3.47
Rumination	4.47 ± 2.84	3.97 ± 2.80
Magnification	4.71 ± 2.01	3.57 ± 2.22

SD: Standard deviation

As seen in table 2, there is a significant difference in the helplessness parameter between patients with chronic back pain and controls ($P < 0.05$) ($df = 103.98$; $t = 2.548$). However, the rumination and magnification parameters were not significantly different between the experimental and control groups ($P < 0.05$).

In table 3, it can be seen that ($df = 110.62$; $t = 2.557$) there is a significant difference between the patient group and control group in the incongruent situation of the dot-probe task, whereas there is no significant difference between them in the incongruent situation of the dot-probe task.

Table 2. Comparison of pain catastrophizing (t-test results)

	Mean	df	Mean difference	t	Standard error difference
Rumination	0.571	65	0.501	0.726	0.689
Magnification	0.365	65	1.130	2.185	0.517
Helplessness	0.013	58.407	2.704	2.548	1.067

df: Degree of freedom

Table 3. Comparison of reaction time between the two groups

	Mean	df	Mean difference	t	Standard Error difference
Congruent	0.616	65	1.749	0.069	40.112
Incongruent	0.053	61.708	94.086	2.557	36.801

df: Degree of freedom

Discussion

Our findings revealed a significant difference in pain catastrophizing parameters between the two groups. Similarly, there was a significant difference between the groups in terms of the incongruent presenting situation in the dot-probe task.

The results related to pain catastrophizing were consistent with previous studies. However, the results of the present study did not support the results of the research performed by Fashler and Katz (2014). In their study, the participants were not diagnosed by a specialist and the criteria were based on individual reports about pain duration and severity.

It is possible that, in present study, pain catastrophizing was the consequence of experiencing long-term pain. Based on the wrapped model, pain catastrophizing can result in the transformation of acute pain into chronic pain. Over-processing pain symptoms affect the severity of pain experienced by patients. In fact, patients with chronic pain magnify minor pain signs several times. The frequent use of the magnifying mechanism put the patient in a situation called "catastrophizing wrapped". Those patients who are catastrophizers experience more difficulty in managing thoughts related to pain in comparison with non-catastrophizers.

Catastrophizers ruminate on painful thoughts and their cognitive activity is reduced by "pain expectations". The findings on attentional bias were in line with that of previous researches. However, the findings of the present study were in contrast with the research conducted by Lioffi et al. (2011).

The second phase of the "motivational attention model toward pain" states that if a person is seeking a goal that is related to pain, especially with focus on pain

management, it is predictable that a greater amount of attentional bias will be assigned to pain. The schemas of patients with chronic back pain are formed based on catastrophizing and magnifying of pain symptoms. These individuals consciously try to manage and avoid pain experience, which is a pain-related goal. Therefore, more attentional bias is observed in the patient with chronic back pain.

In the comparison between healthy individuals and patients, the longer the reaction time was in incongruent situation, the more attentional bias was observed. Incongruent presenting is the situation in which the place of presenting the arrow on the screen is not the same as the place of presenting the pain stimuli. The longer reaction time in an incongruent situation in patients with chronic back pain compared to controls indicates that facing pain stimuli causes patients to pay more attention to pain. Thus, it takes more time and effort to withdraw attention from stimuli and direct attention and involvement toward the arrow.

Previous studies have shown that the average reaction time in patients with chronic back pain is longer than that in healthy individuals. This means the patients have more inclination toward pain stimuli which is called "tendency bias". These patients' long-term involvement with pain renders them more vulnerable and sensitive to pain stimuli.

Therefore, patients with acute pain or short-term pain experiences display less attentional bias compared to patient with chronic pain.

The differences in the results of the current study and those of Lioffi et al. (2011) could be the consequence of representing time of stimuli and assessing the different stages of attention simultaneously. Longer presentation leads to a more conscious

reaction by the respondents because they deal with the stimuli for a longer time, and therefore, have more time to use schemas and make meaning of the stimuli. Hence, increasing the presenting time could lead to more significant differences between groups.

Conclusion

Patient with chronic back pain show more attentional bias toward pain stimulus and magnify the symptoms related to painful experiences.

The importance of psychology in the expression, understanding, and treatment of pain was recognized in early researches, and there are a number of cases for whom the extent of damage is not consistent with the experience of pain. There are also a number of cases for whom the extent of damage and pain are not consistent with the experience of disability. In addition to personality, gender, age, and culture, there are some specific psychological factors that affect individuals' experience of pain (Eccleston, 2001).

Recent studies have suggested that reassuring patients with an acute bout of low back pain and encouraging a return to normal activities may be helpful in preventing the development of chronic disability (Linton, Boersma, Jansson, Svard, & Botvalde, 2005).

Psychologists play an important role in the management of pain in patients with chronic back pain, and to guarantee a successful outcome, knowing the exact mechanism of patients' cognitive schemas of pain perception seems to be necessary. As demonstrated in this research, patients with chronic back pain catastrophize pain signs and pay more attention to pain stimuli than healthy individuals.

The limitation of this study were the lack of access to equipment for measuring eye-tracking and a delay between the start of attention process and pressing the key on the keyboard by respondents. Moreover, the place of respondents' hand could affect the reaction time; therefore, we suggest that

similar studies be conducted on other chronic pain patients in order to discover whether the delay time is effective on attentional bias in this group of patients.

Conflict of Interests

Authors have no conflict of interests.

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