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The Contribution of Posttraumatic Stress Symptoms to Chronic Pain Adjustment

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Objectives: To examine whether there are differences between non-trauma-exposed, trauma-exposed without posttraumatic stress symptoms (PSS), and trauma-exposed with PSS chronic musculoskeletal pain patients in vulnerability, protective, and pain-adjustment variables; to test the interactive relationship between PSS and the vulnerability and protective psychological variables across pain adjustment in the group of trauma-exposed-patients. ***Method:*** 714 patients with chronic musculoskeletal pain were assessed. Of these, 346 patients (244 women and 102 men) completed the study (117 non-trauma-exposed, 119 trauma-exposed without PSS, and 110 trauma-exposed with PSS). The instruments used were the Stressful Life Event Screening Questionnaire Revised, Davidson Trauma Scale, Anxiety Sensitivity Index, Acceptance and Action Questionnaire, Pain Catastrophizing Scale, Fear-Avoidance Beliefs Questionnaire, Pain Anxiety Symptoms Scale, Pain Vigilance and Awareness Questionnaire, Resilience Scale, Chronic Pain Acceptance Questionnaire, Pain Numerical Rating Scale, Roland Morris Disability Questionnaire, and Hospital Anxiety and Depression Scale. ***Results:*** Eight ANCOVAs showed that there were statistically significant differences in vulnerability, protection, and pain adjustment variables between the trauma-exposed with PSS patients and the other 2 groups. The moderated multiple regression analyses showed that PSS added a significantly incremental variance to pain intensity, emotional distress, and disability when interacting with vulnerability and protection variables. ***Conclusion:*** The current study supports the models of posttraumatic stress and chronic pain, such as the mutual maintenance and the shared vulnerability theories, providing an initial comprehensive framework for understanding the comorbidity of both disorders.

Keywords: chronic pain, pain adjustment, PSS, psychological variables

Several studies (Otis, Keane & Kerns, 2003; Shipherd et al., 2007) have suggested that the presence of posttraumatic stress disorder (PTSD) may be a potential mechanism that could explain the relationship between exposure to a traumatic experience and a chronic pain condition. The high rate of comorbidity between both disorders, estimated to be between 20% and 34% for patients referred for pain rehabilitation (Otis et al., 2003), suggests that there may be biological and psychological vulnerabilities that contribute to the development of both conditions. In addition, PTSD and pain may share specific psychological vulnerability such as the tendency to respond to physical sensations with fear (Asmundson et al., 2002; Otis et al., 2003; Sharp & Harvey, 2001). This tendency is reflected by variables such as anxiety sensitivity (AS), experiential avoidance (EA), catastrophizing, fear of pain, and hypervigilance.

AS, catastrophizing, pain-related fear, and hypervigilance have been proposed as psychological vulnerability factors for both conditions (Asmundson et al., 2002; Sharp & Harvey, 2001). Nonetheless, only a few studies have examined these factors in chronic pain patients with posttraumatic stress symptoms (PSS). The study by Martin et al. (2010) showed that AS was a predictor of catastrophizing, fear of pain, and PSS in chronic pain patients waiting for surgery. Only two recent studies have evaluated pain-related hypervigilance among chronic pain patients with PSS. One study was conducted by Ruiz-Párraga et al. (2009). Their findings indicated that chronic pain patients with PSS had higher scores in pain-related hypervigilance than non-trauma-exposed and trauma-exposed without PSS chronic pain patients. The results of the second study showed that pain-related hypervigilance predicted an increase in pain intensity and a decrease in pain acceptance (Tsui, Stein & Sonty, 2011).

Much less attention has been paid to those variables that could be considered protective factors for both disorders. Resilience is one such variable among these. There is a broad consensus that

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resilience is a dynamic process that involves overcoming the negative effects of exposure to risk, successfully coping with adverse experiences and avoiding negative trajectories associated with risk (Ruiz-Párraga, López-Martínez and Gómez-Pérez, 2012). Resilience, considered as a personality trait with a positive effect on dealing with trauma, has been proposed as a salutogenic factor that protects individuals from PTSD by buffering the effects of PTSD risk factors (Bensimon, 2012; McFarlane, van Hooff & Goodhew, 2009). Recently, further studies have also supported the protective role of resilience in adjustment to chronic pain (Ruiz-Párraga et al., 2012). Considered as a whole, the empirical findings indicate that resilience involves the ability to adapt to pain, as resilience has been shown to be associated with higher levels of pain acceptance and active coping, and with lower levels of pain intensity, disability, catastrophizing, and emotional distress.

Only one study has evaluated protective psychological variables such as resilience and pain acceptance in chronic pain patients with PSS (Ruiz-Párraga et al., 2009). The study, which was conducted with women alone, found that trauma-exposed chronic pain patients without PSS had higher scores in resilience and pain acceptance than trauma-exposed chronic pain patients with PSS. In fact, pain acceptance has also been shown to play a protective role in the pain experience. Some studies have found that pain acceptance is associated with lower pain intensity, improved daily functioning, and better mood (McCracken, 1997; McCracken, Vowles & Eccleston, 2004), and negatively associated with higher avoidance levels and pain-related disability (McCracken & Samuel, 2007).

This study has 3 aims: (1) to examine differences in vulnerability and protective psychological variables between three groups of chronic musculoskeletal pain patients: patients exposed to traumatic events with PSS (TE with PSS), patients exposed to traumatic events without PSS (TE), and patients who had never been exposed to trauma (NTE). We hypothesized that TE with PSS patients would show significantly higher scores in AS, EA, catastrophizing, fear-avoidance beliefs, fear of pain, and pain-related hypervigilance, as well as lower scores in resilience and pain acceptance than the other two groups; (2) To explore differences in pain adjustment between the groups. It was predicted that TE with PSS patients would have significantly higher scores in pain intensity, pain disability, and emotional distress, and that no differences would be found between the NTE patients and the TE patient groups in pain adjustment variables; (3) To test the effects of the interactions of PSS and the vulnerability and protective psychological variables across pain adjustment. It was hypothesized that both factors, PSS and psychological variables (AS, EA catastrophizing, fear-avoidance beliefs, fear of pain, pain-related hypervigilance, resilience, pain acceptance), may additively combine to compound pain intensity, pain disability, and emotional distress, making a cumulative but independent contribution to chronic pain adjustment.

Method

Participants

A total of 714 patients with chronic musculoskeletal back pain were assessed. They had been referred by physicians and physiotherapists from several Primary Care Health Centres in Málaga (Spain). Regarding the clinical pain condition, the following inclusion criteria were considered: age between 18 and 65 years; back pain of benign origin (cervical, thoracic, lumbar, and sacral); 6 or more months duration; pain intensity 3 or above on the Pain Numerical Rating Scale of 10 points (Jensen, Turner, Romano & Fisher, 1999); and continuous or intermittent pain that appears 5 or more days per week. Patients with severe injuries which required immediate surgery, presence of other chronic diseases involving disability such as cardiopathies, mental and/or neurological diseases, and concurrent involvement in a legal process for receiving a pension as a result of pain were excluded. In addition, various criteria related to the experience of traumatic event and posttraumatic symptoms were applied to select the three groups of patients (NTE, TE, and TE with PSS; see Figure 1): a) exposure to a traumatic event: 365 patients reported having been exposed to a traumatic situation versus 349 who had never been exposed to a traumatic event; b) timing of exposure to trauma: the second criterion was to select only those participants who had been exposed to a traumatic event before the onset of pain. Thus, 12 patients were excluded because pain onset occurred before they were exposed to a traumatic event; c) traumatic events scores: only those patients with scores equal to or higher than 8 points on the fear and hopelessness scales of the Stressful Life Event Screening Questionnaire Revised (SLESQ-R; Green, Chung, Daroowalla, Kaltman and DeBenedictis, 2006) were considered as trauma-exposed participants. Thus, a participant was considered to have a positive history of exposure to traumatic events when he or she answered *Yes* to one of the SLESQ items and responded with a score of 8 or more on the fear or hopelessness scale. For this reason, 88 patients with a score of 7 or less on both scales were excluded; and d) presence of PSS: participants also completed the Davidson Trauma Scale (DTS; Davidson, 1996) only if they endorsed experiencing at least one of the items of the SLESQ-R. Only participants with a score ≥40 on the DTS were considered to be suffering from PSS. In total, 110 of the 265 trauma-exposed patients obtained a score higher than 40 points. To ensure the absence of subthreshold posttraumatic stress symptoms in the TE group, only patients with DTS scores less than 30 were retained. Thus, 36 patients with scores between 30 and 40 on the DTS were excluded from the analysis because this number of cases is less that that required for the ANCOVA.

Therefore, a total of 346 patients were divided into three groups: 117 NTE patients (69.2% women), 119 TE patients (69.7% women), and 110 TE with PSS patients (72.7% women). To maintain a similar number of patients in all the groups, the patients in the NTE group were randomly selected from the 349 non–trauma-exposed patients. The majority of patients of the three groups (NTE, TE, and TE with PSS) were married (75.2%, 68.1%, and 65.5%, respectively), some had secondary education (35.9%, 44.5%, and 28.2%, respectively), and were employed (59.8%, 46.2%, and 48.2%, respectively). Their ages ranged from 32 to 60 years (M = 43.45, SD = 11.68; M = 44.11, SD = 11.21; and M = 47.06, SD = 12.46, respectively).

Table 1 shows the clinical characteristics of the three groups of patients, as well as the kinds of traumatic events, physical injuries during trauma experiences, and DTS scores of the sample of patients with TE (with or without PSS).

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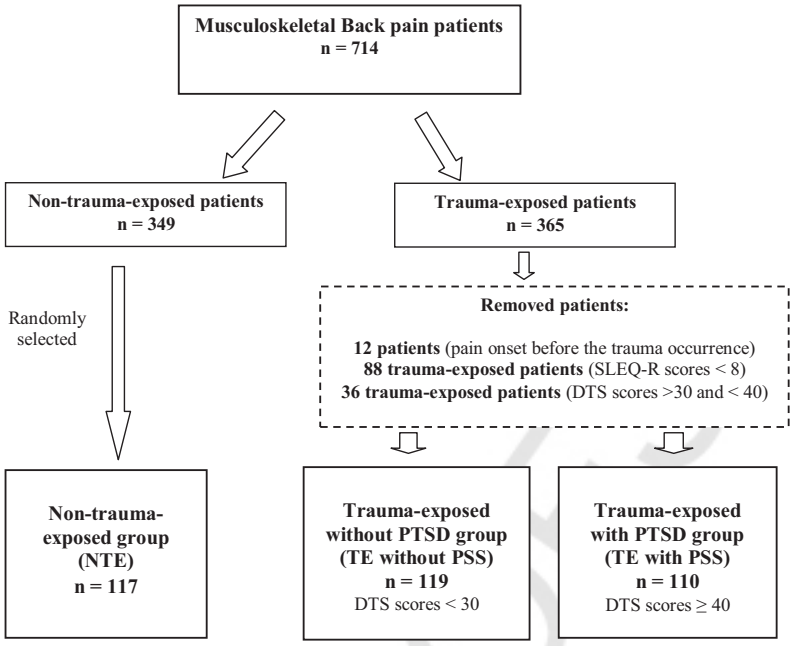

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Figure 1. Selection of the three groups of patients.

Measures

Demographics and pain variables. Patients completed a questionnaire on their demographic characteristics and the variables associated with their medical history.

The Stressful Life Event Screening Questionnaire Revised (SLESQ-R; Green et al., 2006). The SLESQ-R was developed as a general traumatic event screening questionnaire for use in a non-treatment-seeking sample and to identify criterion A events usually associated with PTSD (Goodman, Corcoran, Truner, Yuan and Green, 1998). It has very good test–retest reliability and provides good discrimination between criterion A and noncriterion A events (Goodman et al., 1998). Because it does not assess criterion A2 of the PTSD diagnosis, participants were asked to rate from 0 (*Not at all)* to 10 (*Extreme intensity*) the fear experienced during the event, as well as their feelings of helplessness. Criterion A2 was considered fulfilled when a participant responded with a score of 8 or more to the fear or helplessness scale. This decision was made to ensure that the stressor events were confirmed as being traumatic by the patients and no merely potentially traumatic. Hence, only those patients with a high negative appraisal of the experience were selected as trauma exposed. An additional Yes/No question was included to assess whether the traumatic event had caused physical injury. If the response was affirmative, the subject was asked to describe the kind of injury.

The Davidson Trauma Scale (DTS; Davidson, 1996). This self-rating questionnaire was developed for use in diagnosing and measuring the severity of symptoms and treatment outcome in PTSD. The Spanish version was used in this study (Bobes et al., 2000). The items on this scale measure the 17 PTSD symptoms described in *Diagnostic and Statistical Manual of Mental Disorders*, fourth edition (*DSM–IV*). Each DTS item is measured on a 0–4 scale of severity and frequency, such that the maximum possible score is 136. Scores on the DTS can differentiate patients with PTSD and partial PTSD from patients without PTSD in the general population. It has good test–retest reliability, internal consistency, and convergent and divergent validity, as well as current validity. Diagnostic assessment using the DTS is reasonably accurate compared to the SCID. Subjects with a DTS score of 40 or more are considered to have a probable diagnosis of PTSD, whereas scores between 30 and 40 are considered as probable subsyndromal PTSD (Davidson et al., 2002).

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Anxiety Sensitivity Index (ASI; Reiss, Peterson, Gursky, & McNally, 1986). The ASI is a self-report measure of AS. It comprises 16 items using a 5-point Likert-type format ranging from 0 (*Very little*) to 4 (*Very much*). The ASI has high levels of internal consistency, good test–retest reliability and excellent convergent validity. The Spanish Version of the ASI is fully equivalent to the original and provides cross-cultural evidence for construct validity and concurrent validity (Sandín, Chorot, and McNally, 1996).

Acceptance and Action Questionnaire (AAQ; Hayes et al., 2004). The AAQ is a 9-item questionnaire designed to measure the tendency to engage in experiential avoidance. Each item is rated on a 7-point scale ranging from 1 (*Never*) to 7 (*Always*). The AAQ has good psychometric properties (Hayes et al., 2004). The Spanish adaptation (Barraca, 2004) has psychometric properties similar to the original one, with good internal consistency, good test–retest reliability, and concurrent validity.

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Pain Catastrophizing Scale (PCS; Sullivan, Bishop & Pivik, 1995). The PCS is composed of 13 items on a 5-point scale, ranging from 0 (*Not at all*) to 4 (*All the time*). The PCS was developed to assess 3 components of catastrophizing: rumination, magnification, and helplessness. It has excellent psychometric properties and has been widely used in research. The Spanish version (Muñoz and Esteve, 2005) used in this study has high

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Table 1
Clinical Variables of the Three Groups of Participants

Variables	NTE (n = 117)		TE (n = 119)		TE with PSS (n = 110)		
	Mean/n	SD/%	Mean/n	SD/%	Mean/n	SD/%	$F/\chi^2/t$
Pain duration (years)	3.04	2.44	4.07	3.47	4.41	3.80	1.73
Site of pain							
Cervical	67	57.3%	73	61.3%	70	63.6%	6.21
Thoracic	42	35.9%	39	32.8%	41	37.3%	1.73
Lumbar	101	86.3%	105	88.2%	98	89.1%	6.44
Sacral	70	59.8%	72	60.5%	73	66.4%	5.99
Traumatic events							
Life-threatening illness			23	19.3%	19	17.3%	.02
Life-threatening accident			37	31.1%	19	17.3%	5.09*
Robbery with physical force			22	18.5%	21	19.1%	.04
Death of a very close person			37	31.1%	68	61.8%	21.73**
Sexual abuse			16	13.4%	19	17.2%	.10
Physical abuse			14	11.8%	53	48.2%	11.87**
Emotional abuse			27	22.7%	64	58.2%	30.70**
Being threatened with a weapon			9	7.6%	14	12.8%	.08
Witness to violence			9	7.6%	20	18.2%	5.82*
Other life-threatening situations			3	2.5%	6	5.4%	.12
Miscarriage			21	17.6%	9	8.2%	4.49*
Other			11	9.2%	36	32.7%	19.33**
Number of trauma experiences			1.92	1.18	3.16	2.00	−5.99**
Davidson Trauma Scale scores			3.40	5.59	60.37	13.82	−40.20**
Physical injuries attributable to trauma			37	31.1%	41	37.3%	.97

Note. NTE = non-trauma exposed; TE = trauma-exposed; TE with PSS = trauma-exposed with posttraumatic stress symptoms.
* $p < .05$. ** $p < .01$.

internal consistency (α = .94). The PCS total score was used in this study

Fear-Avoidance Beliefs Questionnaire (FABQ; Waddell, Newton, Henderson, Somerville and Main, 1993). The FABQ is a 16-item self-report questionnaire focusing on patients′ beliefs about how physical activity and work affect low back pain. Each item is answered on a 7-point Likert scale (from *Strongly agree* to *Strongly disagree*). The factors have good internal consistency. The Spanish Version (Kovacs, Muriel, Abraira, Medina and Olabe, 2006) has high internal consistency (α = .93) and validity.

Pain Anxiety Symptoms Scale (Short Form) (PASS-20; McCracken & Dhingra, 2002). Fear of pain was assessed using the PASS-20, a 20-item self-report measure designed to assess anxiety and fear responses associated with the experience of chronic or recurrent pain. This measure was constructed by extracting 20 items from the original 40-item measure each rated on a 5-point scale from 0 (*Never*) to 5 (*Always*). The Spanish version of this inventory (López-Martínez, Esteve-Zarazaga and Ramírez-Maestre, 2011) has reliable internal consistency and validity.

Pain Vigilance and Awareness Questionnaire (PVAQ; McCracken, 1997). The PVAQ was developed as a broad measure of attention and hypervigilance to pain. It consists of 16 items divided into two subscales (attention to pain and attention to changes in pain); the respondents are asked to indicate how frequently each item is a true description of their behavior on a 6-point scale ranging from 0 (*Never*) to 5 (*Always*). It has good internal consistency and adequate test–retest reliability. The Spanish version (Esteve et al., 2013) is a reliable and valid measure. The PVAQ total score was used in this study.

The Resilience Scale (RS; Wagnild & Young, 1993). This scale assesses resilience, taking it to be a positive personality characteristic that moderates the negative effects of stress and promotes adaptation. The original scale (RS-25), which was developed for the general population, comprises 25 items scored on a 7-point scale ranging from 1 (*Disagree*) to 7 (*Agree*). The version used in this study was the recent adaptation for patients with chronic musculoskeletal pain (Ruiz-Párraga et al., 2012). The questionnaire consists of a one-factor solution with 18 items with good internal consistency, stability, and construct validity.

Chronic Pain Acceptance Questionnaire (McCracken, Vowles & Eccleston, 2004). The CPAQ is a 20-item scale assessing acceptance of pain. The items are rated on a scale from 0 (*Never true*) to 6 (*Always true*). It has good internal consistency and concurrent validity. Like the original questionnaire, the Spanish Version (CPAQ-SV; Bendayán, Esteve and Blanca, 2012) has good internal consistency and construct validity.

Pain Numerical Rating Scale (Jensen et al., 1999). According to the recommendations of Jensen et al. (1999), patients were asked to rate their lowest, medium, and strongest pain during the previous week, as well as their current pain, on a scale ranging from 0 (*Not at all*) to 10 (*Extremely painful*). The mean of these four scores was calculated to obtain the average pain intensity.

Roland Morris Disability Questionnaire (RMDQ; Roland & Morris, 1983). The RMDQ consists of 24 items in which the responders are asked to rate the degree to which pain interferes with functioning in different areas of life. Ratings may range from 0 (*No disability*) to 24 (*Maximum disability*). The Spanish version of this scale (Kovacs et al., 2002) has suitable reliability and validity.

Hospital Anxiety and Depression Scale (HADS; Zigmond & Snaith, 1983). The HADS comprises two 7-item scales designed to rate depression (HADS-D) and anxiety (HADS-A), respec-

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tively. The scores from both scales can be added to produce a total score (HADS-T). Ratings may range from 1 (*Almost always*) to 4 (*Almost never*). The Spanish version used in this study (Quintana et al., 2003) has suitable reliability.

Procedure

Before data collection, the researchers held a meeting with the participating doctors in which the eligibility criteria were explained and the procedures were decided on. At the end of their medical visit, each patient who fulfilled the eligibility criteria was informed by their doctor of the study aims and their participation was requested. More than 30% of patients refused to participate in the study. The participants who accepted were contacted by telephone to make an appointment. No one refused participation. Each participant completed a battery of questionnaires in the same order in an oral semistructured interview format with a psychologist lasting 1.5 hours. All patients were interviewed at their clinic, while waiting to be seen by their physicians. Informed consent was obtained prior to data collection. Patients were aware that the information collected was confidential. The research project was approved by the Ethics Committees of the Málaga and Costa del Sol Health Districts (Spain).

Data Analyses

All the statistical analyses were conducted using the SPSS software package 19.0. A preliminary examination of the data was conducted. Missing scores were studied first. Inspection of the within-Groups Mahalanobis' distance showed an absence of multivariate outliers. Moreover, the results of evaluation of assumptions of normality and homoscedasticity were satisfactory.

A stepdown analysis was performed to examine the relative importance of anxiety sensitivity, experiential avoidance, fear-avoidance beliefs, fear of pain, pain hypervigilance, resilience, pain acceptance, pain intensity, pain disability, and emotional distress in differentiating the three groups of patients (NTE, TE, and TE with PSS). Before this, to minimize the number of variables in the analyses, a confirmatory factor analysis via a structural equation model with maximum likelihood estimation was performed using AMOS Graphics (version 19.0). One latent variable called pain fear-avoidance and four observed variables were used. Then eight ANCOVAs were conducted in which the number of trauma exposure events was used as covariate. Post hoc comparisons were conducted using Bonferroni correction to address the problem of Type I errors associated with multiple comparisons. Statistical power was also calculated to examine the risk of type II errors.

To test the effects of the interactions of PSS and psychological variables (AS, EA, catastrophizing, fear-avoidance beliefs, fear of pain, pain-related hypervigilance, resilience, pain acceptance) on pain adjustment (pain intensity, pain disability and emotional distress), a series of moderated multiple regression analysis were performed. These analyses were conducted using the data of the TE with and without PSS groups ($n = 229$). A series of standardized product variables were then created to represent the interactions between PSS and the predictors. Interaction effects were only analyzed in those cases in which the predictors significantly predicted the outcome variables considered in the analyses.

Results

Preliminary Analyses

The results of the confirmatory factor analysis showed an adequate fit of the structural model, $\chi^2(2) = 1.06$, $\chi^2/dl = .53$, $p = .590$; RMSEA = .01; CFI = .99; NNFI = .99; TLI = .98, indicating that pain fear-avoidance as a latent variable was specified by catastrophizing, fear-avoidance beliefs, fear of pain, and pain-related hypervigilance.

Several within-Groups Student *t* tests were conducted for each dependent variable for men and women. The results showed that the means of all dependent variables scores were comparable for men and women in the TE and TE with PSS groups. Regarding the NTE group, significant differences were found between men and women in the emotional distress variable alone (*Mean* = 35.70, *SD* = 8.86; *Mean* = 38.10, *SD* = 6.12, respectively). No significant differences were found in age between the three groups of patients. Several chi-square Pearson tests (or χ^2 Fisher tests when the expected frequency was less than 5) showed that there were no statistically significant differences between groups in the frequency of men and women or in employment status. There were statistically significant differences between groups in marital status (higher frequency of separated patients in the TE with PSS group, $\chi^2(2, n = 346) = 13.46$, $p = .036$, and in educational level (higher frequency of low educational level in the TE with PSS group, $\chi^2(2, n = 346) = 35.60$, $p < .001$. In relation to clinical variables, Table 1 shows the differences between groups.

Taking all these results into account, the analyses were conducted without separating any of the groups of participants by gender. In addition, the mean number of the trauma-exposure events was also considered in the analyses.

Differences in Vulnerability, Protective, and Adjustment to Pain Variables

Table 2 shows the descriptive statistics for the variables considered in the analysis. T2

The results of the ANCOVAs (see Table 3) showed that there were significant differences between the groups in all the variables. T3

Post hoc analyses showed that there were statistically significant differences between the TE with PSS patients and the other two groups of patients (NTE and TE) in all the variables considered in the analysis; specifically, the TE with PSS group had higher means in AS, EA, catastrophizing, fear-avoidance beliefs, fear of pain, pain-related hypervigilance, pain intensity, pain disability, and emotional distress. The TE with PSS group had lower means in resilience and pain acceptance. In addition, there were no statistically significant differences between the NTE and TE without PSS groups in any of these variables.

Interaction Effects of PSS and Psychological Variables on Pain Adjustment

Although AS, pain-fear, resilience, and pain acceptance significantly predicted pain intensity, the moderated regressions showed that PSS only added an incremental variance of 1.4% (B = .003, $p < .05$) when interacting with pain-fear. The interaction between

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Table 2
Descriptive Statistics of the Vulnerability, Protective, and Adjustment to Pain Variables

Variables (range)	NTE (n = 117)			TE (n = 119)			TE with PSS (n = 110)		
	n	Mean	SD	n	Mean	SD	n	Mean	SD
Vulnerability									
Anxiety sensitivity (16–80)	117	36.88	11.03	119	34.88	11.04	110	44.43	12.98
Experiential avoidance (9–63)	117	39.04	6.13	119	39.56	4.09	110	41.68	4.36
Catastrophizing (13–52)	117	20.54	6.53	119	20.97	6.94	110	31.86	10.33
Fear-avoidance beliefs (0–90)	117	21.21	15.90	119	25.73	18.01	110	37.24	17.31
Fear of pain (0–100)	117	30.35	14.00	119	27.89	16.41	110	51.14	16.81
Pain hypervigilance (0–80)	117	22.86	6.26	119	21.65	7.36	110	29.70	6.65
Protection									
Resilience (18–126)	117	94.44	13.45	118	95.91	12.89	110	73.97	13.18
Pain acceptance (0–120)	117	70.10	12.52	119	72.84	15.91	110	57.40	10.75
Adjustment to pain									
Pain intensity (0–10)	117	4.95	1.59	119	5.18	1.43	110	6.23	1.61
Pain disability (0–24)	117	8.96	5.47	119	8.93	5.14	110	11.48	5.06
Emotional distress (14–56)	117	34.01	5.90	119	34.40	6.30	110	44.11	3.50

PSS and AS, EA, pain-fear, resilience, and pain acceptance added a significant incremental variance of 5.1% (B = −.004, $p < .001$), 4.7% (B = −.012, $p < .001$), 1.7% (B = −.001, $p < .01$), 1.2% (B = .002, $p < .01$), and 2.5% (B = .003, $p < .01$), respectively, to emotional distress. AS, EA, pain-fear, resilience, and pain acceptance significantly predicted disability, although the moderated regressions indicated that PSS only added an incremental variance of 2.1% (B = −.002, $p < .01$) when interacting with pain acceptance (see Table 4).

Discussion

The main purpose of this study was to examine the differences between three groups of chronic musculoskeletal pain patients (patients exposed to traumatic events with PSS, patients exposed to traumatic events without PSS, and patients who had never been exposed to trauma) in relation to psychological variables that have been proposed as vulnerability and protective factors for both conditions. We hypothesized that trauma-exposed patients with PSS, compared with the other two groups, would show significantly higher scores in psychological vulnerability variables (AS, EA, catastrophizing, fear-avoidance beliefs, fear of pain, and pain-related hypervigilance), as well as lower scores in protective variables (resilience and pain acceptance). No differences were expected between the non–trauma-exposed patients and the trauma-exposed patients without PSS in any of the variables. The results fully support the hypotheses.

Table 3
Differences Between Groups in Vulnerability, Protective, and Pain Adjustment Variables

Variables	F	df	p	Power
Vulnerability				
Anxiety sensitivity	12.60	2/345	.000	1.00
Experiential avoidance	4.91	2/344	.002	.94
Catastrophizing	43.21	2/343	.000	1.00
Fear-avoidance beliefs	20.50	2/345	.000	1.00
Fear of pain	47.10	2/342	.000	1.00
Pain hypervigilance	35.25	2/345	.000	1.00
Protection				
Resilience	59.55	2/344	.000	1.00
Pain acceptance	25.56	2/344	.000	1.00
Adjustment to pain				
Pain intensity	10.46	2/345	.000	1.00
Pain disability	3.73	2/345	.003	.97
Emotional distress	85.30	2/344	.000	1.00

Forty-nine percent (353 patients) of the total sample reported exposure to a traumatic event before pain onset. Of these, 28.33% (110 patients) had scores ≥40 on the DTS and were therefore considered to be suffering PSS. The results showed that the TE with PSS participants presented higher AS scores than the NTE and the TE without PSS patients. This finding indirectly supports the shared vulnerability models of PTSD and chronic pain, which postulate that AS is a central factor in explaining the co-occurrence of PTSD and chronic pain (Asmundson et al., 2002; Otis et al., 2003; Sharp & Harvey, 2001). Likewise, the TE with PSS group presented higher catastrophizing, fear-avoidance beliefs, fear of pain, and pain hypervigilance than the other two groups. These results are in line with the only three similar studies that have been conducted up to the present (Martin et al., 2010; Ruiz-Párraga et al., 2009; Tsui et al., 2011), and are similar to those of McLean et al. (2005). These authors have suggested cognitive and behavioral mechanisms (i.e., catastrophizing, fear of pain, and pain avoidance) by which PTSD may influence pain, and that are described in the fear-avoidance models of chronic pain (Asmundson & Taylor, 1996; Vlaeyen & Linton, 2000). Based on these models, it could be argued that TE individuals with PSS may be more prone to physical deconditioning because they may be sensitized to respond to pain with fear or appraise it in catastrophic terms, as suggested by Asmundson et al. (2002), Sharp and Harvey (2001), and more recently by Sterling and Chadwick (2010), whose findings indicated that fear of pain mediates the association between trauma symptoms and pain perception. Previous studies also showed that after the occurrence of a traumatic event, PTSD is the key variable that predicts the subsequent development of pain (Ciccone et al., 2005).

We are not aware of any previous studies that have evaluated EA in chronic pain patients with PTSD; however, it was expected that the TE with PSS patients would present higher EA scores than

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Table 4
Moderated Multiple Regression Analyses Showing the Contribution of an Interaction Between PSS and Psychological Variables to Predicting Pain Adjustment (n = 229)

	Pain intensity			Emotional distress			Pain disability		
Predictor variables	β	ΔR^2	R^2	β	ΔR^2	R^2	β	ΔR^2	R^2
1. AS	.15*	.13***		.32***	.50***		.22**	.09**	
PSS	.30***			.59***			.17*		
2. AS/PSS interaction	.02	.01	.13	.24***	.05***	.55***	.07	.01	.08
1. EA	.09	.12		.14**	.46***		.20*	.09*	
PSS	.34***			.64***			.20*		
2. EA/PSS interaction	−.03	.04	.12	−.23***	.05***	.50***	.12	−.12	.10
1. FA	.38***	.21***		.21**	.47**		.59***	.27**	
PSS	.12			.54***			−.11		
2. FA/PSS interaction	.14*	.01	.22***	.14**	.02	.48**	−.03	−.01	.26
1. RS	−.25**	.15**		−.27***	.48***		−.30**	.11**	
PSS	.19*			.49***			.05		
2. RS/PSS interaction	−.09	.01	.16	.12*	.01	.49***	−.02	.00	.10
1. PA	−.31***	.19***		−.27***	.49***		−.46***	.20**	
PSS	.20**			.53**			.02		
2. PA/PSS interaction	−.28***	.06	.25***	.18**	.02	.52***	−.17**	.02	.22**

Note. Predictor variables were standardized; AS = anxiety sensitivity; PSS = posttraumatic stress symptoms; EA = experiential avoidance; FA = fear-avoidance; RS = resilience; PA = pain acceptance.
* $p < .05$. ** $p < .01$. *** $p < .001$.

the other two groups, because EA has been proposed as a vulnerability and maintaining factor for PTSD (Marx & Sloan, 2005) and chronic pain (Esteve et al., 2012); the findings have confirmed this prediction.

Up to the present, little account has been taken of the protective factors that could prevent the appearance of psychological and pain disorders in traumatized individuals. However, the ability to adapt to pain may be a factor that protects against the development of chronic pain disorders and it may also play an important role in reducing distress, improving functioning, and maintaining quality of life (Ruiz-Párraga et al., 2012), once the chronic pain disorder has developed. In addition, trauma research suggests that the majority of people exposed to trauma maintain stable equilibrium without the development of reactive psychopathology, thus implying the presence of resilience (Bensimon, 2012). The present data support this, as the TE with PSS group had significantly lower scores than the other two groups of patients in this variable. Moreover, it is noteworthy that the TE without PSS patients had the highest scores in this variable, although the differences did not reach significance compared with the NTE group. These results are in line with previous research that has compared trauma-exposed chronic pain patients, with and without PSS, and non–trauma-exposed patients (Ruiz-Párraga et al., 2009). They also support studies that have demonstrated a negative association between resilience and PTSD (Bensimon, 2012), and that resilience mediates the relationship between trauma and PTSD (McFarlane et al., 2009). On the other hand, it has been demonstrated that resilience is a relevant variable in pain acceptance (Ruiz-Párraga et al., 2009). In line with this, the results of the present study show that the TE with PSS chronic pain patients had significantly lower scores in this variable than the other two groups of patients.

The second objective was to explore the role of these vulnerability and protective psychological variables in the differences in pain adjustment found between the groups (i.e., pain intensity, pain disability, and emotional distress). The results confirmed our predictions. The TE with PSS patients had poor adjustment to chronic pain, with the highest scores in pain intensity, pain-related disability, and emotional distress, showing that PSS has a negative impact on the experience of pain. Additional research has suggested that the occurrence of trauma alone may not be sufficient to explain the effect of pain reports (Otis et al., 2003; Shipherd et al., 2007). In fact, the findings of this study confirm this assertion. There is some evidence that the experience of trauma brings about neurochemical brain changes and that PTSD is associated with several health problems, including musculoskeletal pain (Bowirrat et al., 2010). It is also known that the anterior cingulated cortex may play a significant role in affective pain processing in PTSD, which suggests that disorder-specific aspects have an influence on pain perception rather than on trauma-related factors (Kraus et al., 2009). On the other hand, the accumulation of traumatic life experiences can lead to increased vulnerability and decreased resilience to further trauma. However, not all individuals who encounter stressful life events develop PTSD; interactions between different genes, and between genes and the environment, probably make certain people vulnerable to developing this disorder (Bowirrat et al., 2010). According to the results of the current study, there were no differences between chronic pain patients who had never experienced a traumatic event and those who had been exposed to a traumatic situation, despite them not developing PSS. It should also be noted that subsyndromal PTSD symptoms were controlled for in this trauma-exposed group, as well as the nature of the traumatic event referred to by these patients. Furthermore, the trauma-exposed groups (with and without PSS) were selected from those patients who appraised the traumatic event as involving high levels of fear and/or helplessness. Although the DSM-5 has removed Criterion A2 for the diagnosis of PTSD (American Psychiatric Association, 2013), taking subjective responses into account may be of interest in the research setting regarding some forms of screening, especially considering that the definition and significance of subsyndromal PTSD outside the contexts of diagnosis

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remains unclear. The impact of these subthreshold levels of traumatic responses on Criterion F would be clinically relevant and may partly help to determine the importance of the symptoms, particularly when using symptom questionnaires and cut-off scores to identify the presence of partial PTSD, if not full PTSD (Vázquez, Pérez-Sales and Matt, 2006). However, this could be challenging when comorbidity between subsyndromal PTSD and chronic pain is considered, as the latter disorder also involves significant problems in daily functioning and emotional distress. In these cases the specificity and sensitivity of the criteria should be maximized, thereby minimizing the number of PSS false negatives. According to the findings of the current study, it seems clear that the presence of PSS, but not mere exposure to a traumatic event, is the key variable that explains differences not only in the vulnerability and protective psychological variables involved in the experience of chronic pain, but also in adjustment to this illness.

In line with this, the third objective was to test the interactive influence of PSS and the psychological variables of vulnerability (AS, EA, catastrophizing, fear-avoidance beliefs, fear of pain, and pain hypervigilance) and protection (resilience and pain acceptance) on pain adjustment (pain intensity, pain disability, and emotional distress). The present findings showed that PSS moderated the relationship between pain-fear avoidance and pain intensity, suggesting that the relationships between catastrophizing, fear-avoidance beliefs, fear of pain, pain hypervigilance, and pain intensity were stronger when PSS scores were high. Similarly, PSS strengthened the relationships between AS, EA, pain fear-avoidance, resilience, pain acceptance, and emotional distress. Thus, when PSS scores were high, the relationships between AS, EA, pain fear-avoidance, and emotional distress were stronger. Conversely, the relationships between resilience, pain acceptance, and emotional distress were weaker when PSS was high. In addition, high PSS scores decreased the relationship between pain acceptance and disability. In line with previous research (Katz, Asmundson, McRae & Halket, 2009; Sterling & Chadwick, 2010), these findings indicate that PSS contributes to an increase in pain intensity, emotional distress, and disability.

As far as we know, this is the first study that has simultaneously compared several relevant variables involved in the two disorders in a large clinical sample that included men and women. Although there is a vast literature on pain and traumatic events, as well as on pain and PTSD disorders, the results of this study indicate that the variables associated with adjustment to pain differ depending on the type of patients referred (TE vs. TE with PSS). Therefore, distinguishing between trauma exposure and PSS after trauma is clearly relevant. In addition, a broad range of stressful situations experienced by the patient over their lifetime was evaluated, because the literature shows the importance of conducting studies in which not only one type of traumatic experience is taken into account, but the entire spectrum of life adversities which a person has been exposed to (Cromer, Hernández, and Kendall-Tackett, 2009). Furthermore, the current study controlled for potentially confounding variables that are known to differentiate PTSD patients from pain patients without symptoms of this disorder (Gillock, Zayfert, Hegel & Ferguson, 2005): sociodemographic variables and variables associated with the trauma-exposure event (e.g., the timing of the exposure (before the onset of pain), the nature of the traumatic event, and the absence of subsyndromal levels of PTSD).

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Although the current study sheds some light on our understanding of comorbid pain and PTSD, a number of limitations should be considered in the interpretation of these data. First, although the high scores on the DTS (>40) are indicative of the presence of PTSD, the group of patients assumed to have PSS was selected according to their scores on a self-report questionnaire, although they were not clinically diagnosed. Thus, they could not fulfill all the criteria needed for a full diagnosis of PTSD according to *Diagnostic and Statistical Manual of Mental Disorders*, fourth edition, text revision (*DSM–IV–TR*). Second, the study sample consisted of patients with chronic musculoskeletal pain. Thus, the findings of the present study may only be generalizable to patients with specific pain complaints. Third, self-report instruments alone were used to assess the variables examined. The use of independent corroboration may enhance the validity of self-report measures. Fourth, the study did not control for the possible influence of pain interventions. Finally, the design of the present study was cross-sectional. Thus, it may prove useful to use a longitudinal study design in future research.

Despite these limitations, evidence from the current study supports the proposals of different models of PTSD and chronic pain. It also provides an initial comprehensive framework for understanding the comorbidity of both disorders, which will help to identify different patient profiles and to design new therapeutic protocols and programs adapted to them.

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