






## Empirical Article

# Effectiveness of spontaneous pain coping strategies for acute pain management: A laboratory study

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The aim of the present study has been to analyze the relationship between the use of not previously trained, diverse acute pain coping strategies and levels of pain intensity and pain tolerance in a group of healthy participants. Previous research has analyzed the usefulness of the training of these strategies after several training sessions, but adequate patient training requires a great deal of time. Two hundred and forty healthy people participated in the study. Pain coping strategies was evaluated with a version of CSQ-S. Subsequently, the participants completed a cold pressor test and tolerance test. After that, subjects filled in the adaptation of the CSQ-S about the strategies which they had employed throughout the test. Correlation analyses showed a positive relationship between pain intensity and catastrophizing, distractor behaviors, hoping and ignoring the pain. Pain tolerance correlated with self-instructions, ignoring the pain, reinterpreting the pain, catastrophizing and faith and praying. Regression analyses showed that catastrophizing was found to be the strategy that most predicts the variance of pain intensity, and catastrophizing (negative) and ignoring the pain (positive) and praying (negative) were the most predictive ones for pain tolerance. This is the first laboratory study that identifies the more useful pain coping strategies which can be used by patients without previous training in an acute pain context. The results of this study could be useful in the development of protocols for nurses and other health professionals, especially for situations where potentially painful techniques are to be applied to patients.

*Key words:* Acute pain, pain coping strategies, pain intensity, pain tolerance, clinical context, cold pressor test.

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## INTRODUCTION

Pain is a complex multidimensional experience influenced by biological, psychological, and social factors. This multidimensional nature explains the existing inter-individual variability in the experience of pain (Raja, Carr, Cohen *et al.*, 2020; Vernaza-Pinzón, Posadas-Pérez & Acosta-Vernaza, 2019). The multidimensional models of pain propose that our thoughts, feelings, and behaviors act as modulators in the process of pain perception (Turk & Rudy, 1992). The experimental evidence accumulated to date strongly supports this multidimensional view.

Currently, pain is one of the main reasons for consultation in both primary care and hospital emergencies (Arrebola, García-Delgado, Labrador-Barba, Orera-Peña & Martínez-Martínez, 2016; Caba-Barrientos, Benito-Alcalá, Montes-Pérez, Aguilar-Sánchez de la Torre-Liévana, R., & Margarit-Ferri, 2014). Despite the fact that acute pain plays an important protective biological role as an alarm mechanism which prevents further damage to the organism experiencing pain (Chapman & Vierck, 2017; López-Silva, Sánchez-de Enciso, Rodríguez-Fernández & Vázquez-Seijas, 2007), sometimes pain can arise due to the application of certain types of treatments and certain types of diagnostic tests (Barroso, Santos, Santos, Nunes & Lucas, 2020; Boerner, Birnie, Chambers *et al.*, 2015; Martín-Pintado-Zugasti, López-López, González Gutiérrez *et al.*, 2017), therefore losing its protective value and becoming a potential barrier for the preservation of the organism's health. Thus, when pain appears, it not only becomes an

unpleasant experience, but it also interferes with the correct application and adherence to treatment (Fernández-de-Las-Peñas & Nijs, 2019; Martín-Pintado-Zugasti *et al.*, 2017; Ramírez-Zamora & Meda-Lara, 2014), even affecting the proper execution of diagnostic procedures (Ramírez-Zamora & Meda-Lara, 2014). Because of this, health professionals can play a crucial role in improving patients' pain management. Specifically, knowing which pain coping strategies are effective for both decreasing pain intensity and increasing the time tolerance to painful stimulation in order that patients to better manage pain can be of great clinical relevance. Although there are studies highlighting the effectiveness of training in pain management techniques these programs require an elevated number of sessions, which makes their implementation in the daily clinical practice very difficult.

Coping strategies are defined as cognitive and behavioral efforts made by an individual with the aim of managing the demands of a stressful situation that is considered as excessive, as it surpasses their resources (Lazarus & Folkman, 1984). In this regard, coping strategies play a determining role when facing a possible acute painful stimulus and their study is fundamental when it comes to improving patients' adaptations to tests and interventions involving pain. Despite the great importance of the study of coping strategies to deal with acute pain, it should be noted that most studies have focused on analyzing the role of coping strategies in chronic pain (Crisson & Keefe, 1988; Esteve-Zarazaga, López-Martínez & Ramírez-Maestre, 1999; Kohl, Rief

& Glombiewski, 2012; Lefebvre, Lester & Keefe, 1995). Studies which have analyzed the effectiveness of various coping strategies for acute pain have found interesting results, however, these pain coping strategies show several limitations in their applicability to daily practice in health contexts, such as some potentially painful diagnostic and treatment techniques in medicine, nursing, physiotherapy, or dentistry. The above-mentioned studies tend to focus only on the analysis of certain strategies such as distraction, acceptance, and reappraisal, although there are many other strategies that patients can use. Research on coping with acute pain tends to use methodologies based on prior training of the strategy, analyzing its impact on the patient, and their results are only applicable to clinical situations where such training is possible. Therefore, the results obtained in such studies can be useful only if the clinician has enough time prior to the execution of the diagnostic test or the application of the potentially painful intervention technique. Nevertheless, the daily reality of clinicians is far from this ideal situation, therefore making it necessary to know whether strategies which patients use spontaneously, without previous training, can be useful in helping patients manage the pain associated with different diagnostic and treatment techniques. Thus, identifying these coping strategies could help clinicians give patients simple instructions regarding which strategies, among those frequently used spontaneously, are useful and which are not, allowing their implementation when pain appears, leaving the possibility of further training in pain management only if the situation requires it.

In spite of the benefits of prior training in these strategies, adequate patient training requires a great deal of time (Bennell, Ahamed, Bryant *et al.*, 2012; Quintana & Rincón-Fernández, 2011), and this is not always available to health care professionals. Hence, the aim of this study is to determine the relationship between the use of pain coping strategies which participants already have in their habitual repertoire and are therefore applicable without prior training, and pain intensity and pain tolerance in a laboratory test.

## METHOD

### Participants

The sample consisted of 214 healthy adults, without chronic pain or other chronic pathologies or psychiatric disorders, who voluntarily gave their consent to participate in the study. The inclusion/exclusion criteria were: (1) age between 18 and 65 years old; (2) not presenting psychotic symptoms, history of psychosis or any other major psychiatric disorder; and (3) not having any physical or mental condition that prevented them from offering their informed consent.

### Equipment

Cold pain induction was performed using the cold pressor task (CPT) procedure. This test consists of the induction of pain by introducing the dominant hand into a container with circulating water at 5°C, for which the Huber K20-CC circulating thermostatic bath was used. The test lasted a fixed time of 45 s plus a variable time set by the participant's behavioral tolerance threshold. Participants were instructed at the beginning of the test to hold their hand in the water for at least 45 s. At the end of this period, a warning was presented and thereafter they were told to endure as much additional time as they could.

### Variables and instruments

Intensity of the evoked pain. Perceived pain intensity was measured during the first 45 s of exposure, during which each participant was asked to indicate the intensity of their pain every 15 s using a 100 mm Visual Analogue Scale (VAS; Scott & Huskisson, 1976), in which the left end represented the absence of pain, and the right end represented the maximum pain possible. The VAS scale has good psychometric properties: test-retest reliability  $r = 0.947$ , intraclass correlation coefficient (ICC) = 0.97. The score for each participant was calculated by taking the arithmetic mean of the three measures (15, 30, and 45 s).

*Behavioral pain tolerance.* Each participant's behavioral pain tolerance threshold was assessed. This threshold is defined as the maximum threshold tolerance at which the individual opts for the behavior of escape or withdraw from the painful stimulus. In this situation, participants' maximum tolerated time for the application of the thermal painful stimulus (cold) was evaluated. To assess this aspect during the cold pressor test, every participant was asked to keep their hand submerged in the water even after the end of the 45-s immersion period until they could no longer tolerate the pain. The behavioral tolerance threshold was calculated as the total time for which each participant endured the immersion. The safety measures established by the International Association for the Study of Pain (IASP) were considered, and in no case was the safety limit of 3 min exceeded.

*Coping with pain.* The CSQ-S questionnaire (Buckelew, Conway, Shetty *et al.*, 1992) was used. This version of the questionnaire was used because it is a specific of the Coping Strategies Questionnaire (CSQ; Rosenstiel & Keefe, 1983) for the assessment of acute pain, and it allows researchers to obtain the extent to which the participant uses the following strategies catastrophizing, praying and hoping, reinterpreting pain, diverting attention, ignoring pain, coping self-statements, pain behavior, increasing activity, control over pain and behavioral coping during an episode of acute pain. This version is identical to the CSQ with two exceptions: (1) the items are formulated in the past simple instead of present; and (2) it contains an additional specific scale of acute pain called behavioral coping. Given that there is no Spanish validation of the CSQ-S, the Spanish adaption of the CSQ (Rodríguez-Franco, Cano-García & Blanco-Picabia, 2004) was used modifying the verbal tenses (from present to past simple). Moreover, the seven items which are included in the CSQ-S and which do not appear in the original version of the CSQ were translated (through a translation-back-translation process carried out by three bilingual experts), these items assess behavioral coping strategy specific to acute pain. Specifically, the items are the following: "I clenched my teeth," "I held my breath," "I pinched or rubbed another part of my body," "I closed my eyes," "I shifted my posture to be more comfortable," "focused on my breathing," and "I relaxed my muscles." In the present study, the internal consistency values for each of the subscales were 0.880 for catastrophizing, 0.532 for distraction, 0.872 for self-instructions, 0.724 for ignoring the pain, 0.877 for reinterpreting the pain, 0.610 for hoping, 0.601 for faith and praying, 0.863 for cognitive distraction and 0.657 for behavioral coping.

### Procedure

This study was approved by the ethical committee of the Rey Juan Carlos University (internal record ID 2202201704717). The recruitment of participants was carried out through advertisements on the bulletin boards of various public and private universities and civic centers of the community of Madrid, as well as by publishing it on social networks, taking advantage of the snowball effect for the dissemination of the study. An email and a telephone number were provided so that the potential participant could contact the research team. Then, once the potential participants had contacted the researchers, the details of their participation were explained to them, and the process of filtering by inclusion/exclusion criteria was carried out for the participants wishing to be included in the study.

If the participants met the criteria, they were cited in the experimental clinical psychology laboratory of the Rey Juan Carlos University. Once in the laboratory, participants read and accepted the informed consent form,

they were also allowed to question any aspect of the study. After signing the informed consent form, participants were given the evaluation protocol, where they had to complete sociodemographic data and the sPSTAI-E scale. With the purpose of the participants reviewing and becoming aware of the pain coping strategies which they normally use when experiencing an episode of acute pain, a list of coping strategies was provided. Participants had to read this list, and with the help of the researcher they were asked to indicate whether or not each strategy on the list was used when experiencing pain. This list was based on the CSQ-S questionnaire which includes a list of nine strategies, corresponding to the CSQ-S scales, each one accompanied by both a brief description and an example. Subsequently, the dynamics of the cold pressor test and tolerance test were explained, and a mark was made on the wrist of the subjects, which indicated how far the arm should be inserted into the cold pressor tank. Before submerging the hand into the water participants were instructed to apply, during the test, the strategies which they had identified as commonly used in the list. Later, subjects were informed that, if they were unable to endure the test, they were free to withdraw their hand before the 45 s mark, although it was important for the development of the test that they could endure that interval of time. Finally, after completing the cold pressor test, subjects filled in the adaptation of the CSQ-S scale about the strategies which they had employed throughout the test.

### Statistical analysis

All data were tested for the presence of outliers prior to analysis (no outliers were detected) and tested for normality using Kolmogorov–Smirnov and Shapiro–Wilks tests. As most variables followed non-normal distributions, non-parametric test and Bootstrapping methods were used. In order to determine the relationship between the use during the test of the different coping strategies and pain intensity and pain tolerance, Spearman's correlations analyses were performed. Subsequently, with the aim of determining the predictive power of such strategies on pain intensity and pain tolerance, multiple lineal regression analyses (enter method) were conducted. Sex, age, and educational level were introduced in a first model, in order to control its effect over dependent variables. Those strategies which showed to be related to pain intensity or pain tolerance in correlation analyses were introduced in a second model. As most variables followed non-normal distributions, bootstrapping method was used to carry out regression analyses, performing 2000 resampling iterations. Analyses were performed using IBM SPSS version 27.

## RESULTS

### Descriptive analysis and correlation analyses between the study variables

The age average was 25.8 years ( $SD = 11.6$ ) and a 71% of the sample were women. Table 1 provides information on the marital status and educational level of the participants. Table 2 shows the descriptive statistics (mean and standard deviation) and the potential ranges which were obtained regarding pain intensity, pain tolerance, and the subscales of the CSQ questionnaire.

The results of the analyses of correlations between the coping strategies, corresponding to the eight subscales of the CSQ-S, and the variables of pain tolerance and pain intensity are shown in Table 3. Pain intensity showed significant positive correlations with catastrophizing, distractor behaviors, behavioral coping and hoping. Moreover, a significant negative correlation was found between pain intensity and ignoring the pain. In relation to pain tolerance, the analyses revealed positive correlations with the

Table 1. Sociodemographic variables

Variable	<i>n</i>	%
Marital status		
Single	169	80.1
Married	37	17.5
Divorced	3	9.4
Widowed	2	0.9
Educational level		
Primary	6	2.8
Secondary	17	8.1
Higher education (high school/university)	188	89.1

Table 2. Means, standard deviations and score ranges of the variables under study

	Mean	Standard deviation	Potential range
Catastrophizing (CSQ)	10.83	7.72	0–36
Distractor behaviors (CSQ)	15.51	9.39	0–36
Self-instructions (CSQ)	20.57	6.99	0–30
Ignoring the pain (CSQ)	18.84	6.92	0–42
Reinterpreting the pain (CSQ)	15.97	9.57	0–36
Hoping (CSQ)	5.18	4.49	0–18
Faith and praying (CSQ)	0.86	2	0–18
Cognitive distraction (CSQ)	3.42	4.62	0–18
Behavioral coping	12.43	7.89	0–42
Tolerance (Maximum tolerated time)	58.89	53.05	45–180
Average pain intensity	62.20	16.27	0–100

Table 3. Spearman's correlations between CSQ-S subscales and pain intensity and pain tolerance

	Pain intensity	Pain tolerance
Catastrophizing	0.596**	–0.473**
Distractor behaviors	0.160**	–0.033
Self-instructions	–0.125	0.263**
Ignoring the pain	–0.262**	0.391**
Reinterpreting the pain	–0.125	0.210**
Hoping	0.154*	–0.125
Faith and praying	0.100	–0.214**
Cognitive distraction	–0.039	0.000
Behavioral coping	0.184**	–0.056

\* $p < 0.05$ ; \*\* $p < 0.01$ .

coping strategies of self-instructions, ignoring the pain and reinterpreting the pain, as well as negative correlations with the coping strategies of catastrophizing and faith and praying.

### Multiple linear regression analyses on pain intensity and pain tolerance variables

Regression analyses on pain intensity using bootstrapping procedures (Table 4) showed that, once the effect of the variables sex, age and educational level were controlled, only

Table 4. Linear regression analyses on pain intensity. Bootstrapping method

Model	Bootstrapp <sup>a</sup>			Sig.	95% confidence interval		Tolerance
	B	Bias	SE		Lower	Upper	
1							
Age	-0.014	0.171	2.650	0.005	2.283	12.790	0.973
Sex	7.314	-0.005	0.111	0.910	-0.247	0.195	0.693
Educational level	-2.823	-0.140	3.389	0.406	-9.697	3.633	0.678
2							
Age	2.053	0.122	2.200	0.349	-2.300	6.548	0.889
Sex	0.092	-0.001	0.099	0.354	-0.096	0.289	0.684
Educational level	-0.410	-0.120	2.955	0.888	-6.279	5.296	0.661
Ignoring pain	-0.219	0.000	0.147	0.137	-.507	.090	0.776
Catastrophizing	1.319	0.004	0.144	0.000	1.049	1.607	0.615
Hope	-0.464	-0.011	0.239	0.055	-.961	-0.009	0.786
Distractor behaviors	0.118	0.008	0.347	0.734	-.547	0.798	0.087

<sup>a</sup>Bootstrapp results are based on 2000 samples.

catastrophizing had predictive value, showing a positive relationship with pain intensity. The model including catastrophizing accounts for 41.5% of the variance of pain intensity, significantly increasing the predictor value of the variables age, sex, and educational level by 37.3% of the explained variance (change in  $F = 24.092$ ,  $p < 0.000$ ).

With regards to the criterion variable pain tolerance, after controlling the effects of the variables sex, age and educational level, the coping strategies which had predictive power according to the regression analyses (Table 5) were catastrophizing and praying which showed a negative relationship with pain tolerance, and ignoring the pain which had a positive relationship with pain tolerance. The model explained 32.1% of the variance of pain tolerance, significantly increasing the predictor value of the variables sex, age, and educational level by 28.5% of the explained variance (change in  $F = 15.945$ ,  $p < 0.000$ ).

## DISCUSSION

The aim of the present study has been to analyze the relationship between the use of not previously trained, diverse acute pain coping strategies and levels of pain intensity and pain tolerance during a cold pressor task (CPT) in a group of healthy participants. Pain coping strategies have been previously studied in relation to acute pain, although it is worth noting that most studies have analyzed the use of methods that require a training period, and there is only a scarce number of studies that have used methods which do not require prior training.

In daily clinical practice, it is quite frequent for nurses, odontologists and other health care providers to have to perform tests or interventions which cause pain. In most cases, health care providers do not have enough time to teach the patient coping strategies for each situation. Thus, it can be of great clinical relevance to know whether coping strategies that patients already

Table 5. Linear regression analyses on tolerance. Bootstrapping method

Model	Bootstrapp <sup>a</sup>			Sig.	95% confidence interval		Tolerance
	B	Bias	SE		Lower	Upper	
1							
Age	-20.986	0.355	8.303	0.012	-37.992	-3.389	0.973
Sex	0.425	0.014	0.422	0.315	-0.398	1.284	0.693
Educational level	8.896	0.266	10.655	0.389	-10.700	30.931	0.678
2							
Age	-9.691	0.303	7.578	0.194	-25.278	6.560	0.882
Sex	0.233	-0.003	0.437	0.602	-0.611	1.038	0.681
Educational level	3.515	-0.055	10.017	0.704	-16.817	22.511	0.664
Ignoring pain	2.026	0.040	0.693	0.002	0.635	3.451	0.440
Catastrophizing	-2.467	0.036	0.455	0.000	-3.379	-1.399	0.751
Self-instructions	0.073	0.017	0.636	0.893	-1.187	1.425	0.552
Reinterpreting pain	0.142	-0.010	0.522	0.778	-0.907	1.176	0.882
Faith and praying	-2.795	-0.072	1.325	0.038	-5.220	-0.458	0.681

<sup>a</sup>Bootstrapp results are based on 2000 samples.

have in their habitual repertoire, and can therefore be put into practice spontaneously, are useful to cope with acute pain. In this way, health care providers could, at the beginning of the consultation, explore the strategies that the patient habitually uses to control pain, as well as instructing each patient to use those strategies which have been found to be helpful, therefore saving the patient from using other strategies which can be maladaptive.

The results of this study have shown that the spontaneous use of some coping strategies is related with a worst pain experience, while other strategies are related with less perceived pain intensity and greater pain tolerance. Based on correlational analyses, the most adaptive coping strategies to deal with acute pain, and which can be put into practice in an autonomous way with no previous training, are ignoring the pain, reinterpreting the pain and self-instructions, in relation to both greater pain tolerance and less pain experienced. The coping strategies which can be considered as maladaptive in dealing with acute pain are catastrophizing, distractor behaviors, behavioral coping, hoping and faith and praying. Although data showed the relevance of the above-mentioned coping strategies for acute pain management, a deeper analysis revealed that, when all of them are taking into account in a multivariate way, some of them are revealed as mainly relevant.

According to our results, one of the most relevant coping strategies to manage acute pain is catastrophizing. Catastrophizing is defined as the tendency to interpret the real or anticipated pain in an exaggerated way and has components of magnification, rumination and helplessness (Sullivan, Bishop & Pivik, 1995). This strategy has the highest predictive value on pain tolerance time and pain intensity. Participants who had fewer catastrophic thoughts (e.g., I feel I cannot stand anymore, I worry all the time about whether it will end, It's awful and I feel that it overwhelms me) reported lower perceived pain intensity and tolerated the noxious stimulation for a significantly longer time. Similarly, the predictive role of catastrophizing on pain intensity has been observed in studies with chronic pain populations (Cano-García, Rodríguez-Franco, García-Martínez & Antuña-Bellerín, 2005; Kwissa-Gajewska, Olesińska & Tomkiewicz, 2014; Lau, Leung & Wong, 2002). In relation to acute pain, the data obtained in our study is congruent with the results presented by (Wang, Jackson & Cai, 2016) who suggested that high levels of catastrophizing were associated with lower pain tolerance during a cold pressor test in a sample of healthy participants.

In relation to pain tolerance, other important strategies are ignoring pain and faith and praying. Participants who used strategies based on ignoring the pain had better results in terms of both lower perceived pain intensity and higher pain tolerance. In addition, ignoring pain is one of the best predictors of pain tolerance. Ignoring the pain is a coping strategy based on the withdrawal of attention from the painful stimulus whilst continuing with the activity while ignoring the painful stimulus. The participants who applied this strategy, acting as if the pain was not present and focusing on the goal, presented a higher behavioral tolerance threshold, being able to tolerate the painful stimulation for longer, as well as experiencing lower levels of pain intensity during the fixed stimulation time for all participants (45 s). These results are in line with prior research which has

suggested that a goal-focused attitude, without fixating attention on pain and acting “as if pain does not exist” tends to reduce pain intensity levels in patients with chronic pain (Cano-García *et al.*, 2005; Kwissa-Gajewska *et al.*, 2014). An analysis of the items that make up the scale reveals that the strategy has a double component. On the one hand, a voluntary reduction of attentional and cognitive resources to the painful sensation (e.g., I ignore it, I do not pay any attention to it, I do not think about the pain). On the other hand, this strategy involves individuals focusing their attention on the target task (e.g., Although it hurts, I just keep on going). Therefore, it could be hypothesized that the combination of both processes would make task motivation more predominant over the impulse to withdraw from the painful sensation, which in turn, results both in less perceived pain (probably linked to the attentional component of the strategy) and a higher behavioral tolerance threshold (probably, associated with the motivational aspect of the strategy). On the other hand, these components seem to be associated to processes related to acceptance of emotions and commitment to action, as defined in the Acceptance and Commitment Therapy perspective. This framework is a psychological approach which has proven to be associated to lower levels of pain in patients suffering from chronic pain disorders (Luciano, Guallar, Aguado *et al.*, 2014; Simister, Tkachuk, Shay, Vincent, Pear & Skrabek, 2018; Simpson, Mars & Esteves, 2017). In turn, previous studies have also found that training in acceptance is effective for the management of acute pain (Georgescu, Dobrea & Predescu, 2018; Kohl, Rief & Glombiewski, 2013).

Participants who used praying to deal with pain, reported higher levels of perceived pain intensity and lower pain tolerance in the cold pressor test. To the knowledge of the authors, there are no studies which provide data on the usefulness of these strategies in acute pain. Nonetheless, the studies conducted with patients suffering from chronic pain consistently indicate that the use of this set of strategies is associated with greater pain severity (Hill, 1993; Hill, Niven & Knussen, 1995; McCracken, Goetsch & Semenchuk, 1998) and greater pain-related anxiety (McCracken *et al.*, 1998).

According to the results found in this study, other strategies such as self-instructions and reinterpreting the pain were also associated with higher pain tolerance among the participants. First, self-instructions are a strategy based on positive self-verbalizations about one's own self-efficacy to overcome the task and handle the pain, as well as interpreting of the situation as a challenge to be overcome. These results confirm the crucial role of self-instructions as an adequate strategy for pain management, as has been evidenced for chronic pain management in previous studies (Turner, Jensen, Warms & Cardenas, 2002). Although, the analysis of this strategy in acute pain is very scarce, there are some previous studies which have found similar results to those presented in the current study (Jokic-Begic, Ivanec & Markanovic, 2009; Lu, Tsao, Myers, Kim & Zeltzer, 2007). Second, in relation to the strategy of reinterpreting pain, the scarce number of studies in acute pain consistently indicate that it is an adaptive strategy, in accordance with the results of the present study (Buckelew *et al.*, 1992). Even though reinterpreting pain may be related to cognitive strategies based on the modification of the meaning of pain, a detailed analysis of its

items reveal that this strategy has an important component associated with cognitive distancing and dissociation (e.g., I try to feel distant from the pain, almost as if the pain was in somebody else's body, I imagine that the pain is outside of my body). Regarding dissociation, it is worth noting that there are no current studies available regarding its role in acute pain, whilst in chronic pain patients this strategy is associated to higher levels of pain intensity (Karas, Akgun-Yildirim, Kucukgoncu & Yakut, 2017; Romeo, Tesio, Ghiggia *et al.*, 2021). Nevertheless, (Bob, 2008) found evidence that partially supports the hypothesis that dissociation may be an adaptive coping strategy in the short term, since it reduces levels of physical and emotional pain, whereas in the long term it becomes maladaptive, given that, dissociation increases pain levels (Bob, 2008; Cook *et al.*, 2005).

The data obtained in this study has allowed us to identify other coping strategies which are associated to a greater experience of pain. The results found in the current study suggest that distractor behaviors and behavioral coping are ineffective for pain management, as our results showed that they were associated to higher perceived pain intensity. Thus, the use of strategies such as changing posture, clenching teeth, holding one's breath (behavioral coping) or humming a song (behavioral distraction) were less adaptative for acute pain management. Other studies have found similar results analyzing distractor behaviors (Hill, 1993; Hill *et al.*, 1995), which along with behavioral strategies, has been revealed as a poorly adaptive strategy to cope with pain (Buckelew, Parker, Keefe *et al.*, 1994; Ilves, Hermsen, van der Wouden *et al.*, 2019; Mellegård, Grossi & Soares, 2001; Polański, Jankowska-Polańska, Mazur & Chabowski, 2019).

The present study has limitations which should be considered. First, the manipulation of the independent variable (the type of strategy used) was carried out by instructing each participant to apply in the cold pressor test the strategies that had been indicated as idiosyncratic in the initial questionnaire. Furthermore, the current study design presents limitations to draw firm conclusions about the directionality of the relationship between the variables. Given that the main aim of the study has been to assess differences in the dependent variables (pain intensity and pain tolerance) associated with the use of idiosyncratic patient strategies and without a prior training phase, other different research designs would have made it harder to reach this goal. On the other hand, the study sample consisted of 214 healthy people, without chronic pain, therefore, the results obtained should be taken with caution when generalizing the results to chronic pain populations. Likewise, the sample composed of adults aged between 18 and 65 years old, which also prevents the generalization of results to the pediatric or the elderly population. In addition, the percentage of women is higher than men in the sample. As there are studies which pointed the existence of differences between men and women in different parameters related to pain response (Archev, Goldey, Crockett & Boyette-Davis, 2019; Bartley & Fillingim, 2013; Pieretti, di Giannuario, di Giovannandrea *et al.*, 2016), this disbalance in the men/women percentage should be taken into consideration as a limitation of the study. Also, most of the participants have a higher education level. Previous research has shown contradictory results, some studies have found higher education resulting in lower pain thresholds, but many others have failed in finding this

relationship (Vervullens, Haenen, Meert, Meeus, Smeets, Baert & Mertens, 2022). In any case, the percentage of participants with higher educational levels may be taken into account as a limitation of the study. Another limitation is related with the measurement of four coping strategies, whose internal consistency coefficient does not reach 0.70: distraction, hoping, faith and praying and behavioral coping. Although previous literature indicates that the internal consistency coefficient does not necessarily affect the generalizability of the results to other individuals, it does affect the generalizability to other elements (Leung, 2015; McCrae, Kurtz, Yamagata & Terracciano, 2011), and should be considered as a limitation.

In relation to the relevance to clinical practice, the results of this study could be useful in the development of protocols for health professionals, especially for situations where potentially painful techniques are to be applied to patients. This procedure allows the identification of coping strategies which are in the patient's habitual repertoire and which do not require prior training, these coping strategies can be of great clinical relevance to reduce both pain and discomfort potentially associated with the application of certain techniques.

Based on the data obtained, an acting protocol is proposed consisting of two fundamental steps: first, health providers should carry out the detection of coping strategies that are already in the patient's habitual repertoire by means of the CSQ-S questionnaire. The questionnaire can be filled in by the patient before the consultation, in the waiting room. Second, it could be necessary to provide instructions or guidance for the application of pain coping strategies. At this point, the health care provider can indicate to the patient which of the strategies, that already exist in their repertoire, are appropriate to manage pain, as well as providing brief instructions for their correct application during the test or intervention. This would also allow the professionals to provide instructions in order to avoid the use of maladaptive strategies. If the most useful strategies are not in the patient's habitual repertoire, the health care provider can provide simple instructions, such as those which will be specified ahead in the text, based on the CSQ-S items.

Depending on whether the aim is to control pain for a short time or to achieve increased tolerance pain for a period of time, then the use of the most adaptive strategies to cope with the painful situation will be promoted. In the event that the potentially painful test is applied in a very short time, such as injections or venipuncture for blood extraction, it may be more useful for the patient to use coping strategies which have been shown to be associated to lower perceived pain intensity during the first 45 s of the experimental test. In this situation, the most useful strategy is ignoring the pain which is based on both withdrawing the attention from the noxious stimulus and refocusing attention (e.g., planning activities or focusing on a task or an action requested by the health care provider). Because the application of strategies such as catastrophizing, behavioral coping, faith and praying have led to higher levels of perceived pain intensity in the laboratory test, it would be necessary to indicate to patients who report using them frequently to abstain from applying them as a way of dealing with acute pain. Hence, health care professionals can provide instructions to the patient, such as: "There are strategies that have been proved not to be

helpful to manage the discomfort that may appear, and can even be harmful, for instance: it is preferable that you do not use strategies like clenching your teeth, changing your posture, holding your breath or praying (adapting the instruction to the items that have been marked by the patient when the subscales were administered). Instead, it is preferable that you try to withdraw your attention from the pain, and plan activities mentally or that you focus your attention on other stimuli (the health care professional may suggest a task or the collaboration of the patient in some tasks related to the technique being performed).”.

Increasing tolerance to pain for longer periods can be particularly relevant for treatments or diagnostic procedures that require patients to withstand a painful stimulus for a longer time (e.g., dry needling). In this regard, the instructions given should be oriented towards suggesting to the patient to apply strategies within their habitual repertoire that are related to increasing pain tolerance time, such as reinterpreting the pain, cognitive distancing, self-instructions or ignoring the painful sensation by withdrawing attention and redirecting it to the task. Nevertheless, in the event that patients do not have any of these coping strategies in their respective repertoire and therefore more specific guidance is required, questionnaire-based instructions can be given, such as: “Imagine that the pain is outside of your body, imagine that the pain is not part of you, visualize the pain in another body or on an external object” (reinterpretation and cognitive distancing); “tell yourself that you can handle the pain, tell yourself that you are strong and can continue, try to see the situation as a challenge and tell yourself that you are stronger than the pain” (self-instructions); “try to take your attention away from the pain and focus on other stimuli” (suggest a task or activity related to the technique; ignoring the pain).

The study was approved by the ethical committee of the Rey Juan Carlos University (internal record ID 2202201704717).

All participants read, accepted, and signed the informed consent form.

The data that support the findings of this study are available from the corresponding author upon reasonable request. If would be necessary, data will be deposited in data repository of Rey Juan Carlos University (public repository that issues datasets with DOIs).

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