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Emotional Intelligence and Acute Pain: The Mediating Effect of Negative Affect

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Abstract: Emotional abilities are predictive variables of lower perceived pain. However, no studies have been published investigating the relationship between emotional intelligence (EI), which refers to the ability to accurately perceive, appraise, understand, communicate and regulate emotions, and pain. The objective of the present study was to analyze the influence of EI, measured using the Mayer-Salovey-Caruso Emotional Intelligence Test (MSCEIT), on the level of sensory and affective pain generated by an experimental cold pressor task (CPT). In addition, we examined the influence of negative affect, as measured through the Positive and Negative Affect Schedule (PANAS), on the relationship between EI and pain. Healthy college students (N = 67) completed measures of EI before the CPT, during which they submerged their nondominant hand into ice water, and they completed measures of negative emotional state before and after the CPT. Participants with higher EI rated pain as less intense and perceived it as less unpleasant. Greater emotional intelligence predicted less pain in this experimental paradigm, and the effects seemed to be mediated by the lower NA reactivity associated with greater EI.

Perspective:* *Emotional intelligence is an important element in the processing of emotional information during an experience of acute pain since it reduces the level of negative affect generated by the experimental task.

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Key words: *Emotional intelligence, negative affect, pain, experimental, cold pressor.*

Emotional reactions are included in the formal definition of pain,[17,29] and the experience of pain is multidimensional, going beyond nociceptive stimulation.[18,22,38] Thus, to understand individual differences in the experience of pain, it is necessary to take into account emotional variables.

In particular, the literature points out a relationship between pain and negative affect, clearly indicating the modulating effect of negative emotions on the perception of pain.[13,44] Studies indicate that people with high negative affect have a heightened perception of pain intensity.[2,11,12,39] These results hold in situations of clinical pain[5] as well as in situations of experimentally induced pain.[47] Thus, experimental studies in which a negative affective state is generated indicate that people perceive the pain as greater during the experimental task.[6]

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Although evidence exists about the influence of negative affect on the experience of pain, few studies have examined how individuals' abilities to process and manage emotional states affect the relationship between emotion and pain.[35] In the present study, we investigated the influence of negative affect on the relationship between emotional intelligence (EI) and pain.

EI is defined as "the ability to perceive, appraise, and express emotion accurately; the ability to access and generate feelings when they facilitate cognition; the ability to understand affect-laden information and make use of emotional knowledge; and the ability to regulate emotions to promote growth and well-being".[26] The theoretical model of EI considers this intelligence a relevant variable for explaining individual differences in the processing of affective information.[25] The model is based on the hypothesis that people who accurately understand, appraise, evaluate and regulate their emotions are psychologically healthier and report lower distress, fewer physical symptoms, less stress and less illness.[8,16] Research has shown that EI is associated with lower negative emotionality[8,15] and lower emotional distress when people confront stressful situations.[14] Nevertheless, few studies have examined the relationship between EI and pain.

EI can be an important factor for explaining the perception of pain. It is now widely accepted that subjective pain is critically determined by emotional processing. Several contemporary theories of pain assign prime significance to the role of emotional processes in the perception and communication of pain.[6,18,40] For example, as we argued above, negative affect appears to act by increasing the pain intensity. It can be hypothesized that by adequately processing affective information, people can manage and reduce the negative affect generated in pain-evoking situations, which in turn reduces the perceived intensity of the pain. According to this hypothesis, EI would render the experience less pain-inducing by reducing the level of negative affect associated with it. In this way, negative affect would modulate the relationship between EI and pain.

Results from several studies support this hypothesis and have shown how variables linked to EI, such as emotional regulation and confidence in one's own emotional abilities, are predictive of lower perceived pain.[4,35,46] However, so far, no experimental study has investigated the relationship between EI as assessed through a performance measure, and the experience of acute pain. Moreover, no study has examined the influence of negative affect on the relationship between EI and pain.

The objective of the present study was to analyze the relationship linking EI, as assessed through a performance measure, negative affect reactivity, and the perception of pain generated by the experimental cold pressor task (CPT). In addition, we investigate negative affect as a possible mediator between EI and perception of pain. We hypothesize that negative affect generated by the CPT will influence the predictive relationship between EI and the perception of sensory and affective pain during an experimental task in a sample of healthy people.

Methods

Participants

Participants were 67 university students from the Faculty of Psychology of the University of Málaga (Spain). The sample consisted of 10 males (14.9%) and 57 females (85.1%). Mean age was 21.58 years (SD = .76; range, 21–23). Exclusion criteria were chronic pain problems (eg, fibromyalgia, chronic fatigue syndrome), circulatory problems, hypertension, and diabetes. Participants were also excluded if they had taken any kind of analgesic within the last 24 hours. None of the participants reported a chronic pain condition.

Pain Induction Technique

Following Keogh and Mansoor[20] and Keogh et al,[19] the current study used CPT as the pain induction technique. In order to standardize testing procedures, participants placed their nondominant hand in a cold water bath maintained at a temperature of 1 ± .5°C. The cold pressor apparatus consisted of a container filled with ice-water. The temperature of the ice-water was held constant by periodically adding ice to the container and checking using a thermometer. The ice was removed from the container and the water temperature was recorded for each participant before actual ice-water immersion. Participants were asked to keep their hand immersed for as long as they could tolerate, up to a maximum of 5 minutes, and they were told that they could remove their hand at any time without penalty. This task is viewed as having excellent reliability and validity.[7,45] The pain induction method complied with the International Association for the Study of Pain Ethical Guidelines.[17] The participants signed an informed consent form after understanding the instructions and before the induction of pain. The research study protocol was approved by the Technical Council of the Ethical Committee of the University of Malaga.

Pain Measures

Sensory and Affective Pain

Two dimensions associated with the induced pain were assessed: sensory pain and affective pain.[12] Every 15 seconds during the CPT, participants verbally rated their perception of the strength of the painful stimulus (sensory pain) and the unpleasantness of the pain generated by the painful stimulus (affective pain) using a numerical rating scale (NRS) where "0" corresponded to "no pain" and "10" to "unbearable pain". The average of NRS scores was used to measure both sensory and affective pain.

Time of Immersion

The total interval (in seconds) between hand placement in the tray of cold water and spontaneous hand withdrawal was defined as the time of immersion. The duration of the ice-water immersion was recorded with a stopwatch. A cut-off time of 5 minutes was set for safety reasons. Time of immersion for subjects who did not withdraw their hand during the entire 5 minutes was recorded as 300 seconds (N = 17).

Psychological Measures

Emotional Intelligence

The Mayer, Salovey, Caruso Emotional Intelligence Test (MSCEIT v.2.0[27]) was used to assess EI. This instrument is a measure of ability or performance that assesses people's emotional skills in the performance of various tasks and processing of emotional situations. The MSCEIT assesses the 4 branches of the theoretical model of Mayer and Salovey[26]: emotional perception, emotional facilitation, emotional understanding and managing emotions, both intrapersonal and interpersonal, which combine to form 2 areas (experiential and strategic), and a total score that includes all branches. The psychometric properties of the MSCEIT v.2.0 are appropriate and convergent, and the instrument has discriminant validity.[27] The Spanish version of this instrument has also shown satisfactory psychometric properties.[9] The scale had adequate reliability in this study

(Cronbach's alpha = .77). In this study, we scored the MSCEIT using expert criteria.

Negative Affect Reactivity

The Spanish translation[36] of the Positive and Negative Affect Schedule (PANAS[41]) was used. The PANAS is a self-reported adjective checklist that contains 2, 10-item subscales designed for the assessment of positive affect (active, alert, attention, determined, enthusiastic, excited, inspired, interested, proud, and strong) and negative affect (afraid, ashamed, distressed, guilty, hostile, irritable, jittery, nervous, scared, and upset). In this study, we used only the negative affect subscale. The scale had adequate reliability in this study (Cronbach's alpha = .85). The instructions for completing the PANAS were as follows: "Please indicate with a circle or 'X' the extent to which you feel the following emotional states at this moment. Please pay attention to the format of the answer that you required to give". For each of the 10 emotion-related words, participants used a 5-point scale to rate the extent to which they felt that emotional state before and after the CPT (1 = "very slightly or not at all", 5 = "extremely"). Therefore, participants provided ratings twice, before and after the task; after the task, they were asked to rate the extent to which they had felt each state "during the task". We measured the reaction of NA to the CPT by calculating NA reactivity. This was determined as a residual score from a regression equation that predicted NA during the task from NA before the task. We then used NA reactivity in our analyses.

Procedure

We used a procedure similar to that of other studies.[35] In the first phase of the study, the MSCEIT was administered in a single 60-minute session during normal class hours and in the presence of the principal investigator. Participation was voluntary.

One month later, the participants were requested to participate in the second phase of the study, which was also voluntary. Upon arriving at the laboratory, the participants were given the following written instructions:

"You are going to undergo a physically painful experience. Our goal is to assess your degree of pain. For this purpose, you should place your nondominant hand in a tray of very cold water. It is important to keep your hand in the tray for as long as possible; nevertheless, you can remove your hand if you feel that you cannot stand the painful experience any longer. Periodically (every 15 seconds), we will ask you about the degree of sensory and affective pain you are feeling. You can respond on a 0 to 10 scale for each 1 of these variables, where 0 is no pain and 10 is unbearable pain".

After they had read the instructions, the participants consented to performing the task. Before starting, they completed the negative affect subscale (PANAS). Then the students carried out the CPT. Immediately after removing their hands from the CPT, the participants again completed the negative affect subscale in order to report their affective state during the task.

Table 1. Summary of Pain and Psychological Variables (N = 67 for All Variables)

Measure	Observed Range	Mean (SD)
Sensory pain	3.05–9.25	6.56 (1.62)
Affective pain	2.05–9.75	6.55 (1.71)
Negative affect reactivity	−.85–1.33	0.00 (.43)
Time of immersion (seconds)	15.00–300.00	149.47 (108.36)
Emotional Intelligence	57.81–81.78	71.91 (5.64)

Results

Descriptive and Correlation Analyses

The descriptive statistics of the psychological and pain-related variables are shown in Table 1.

Table 2 shows the results of the bivariate correlation analyses between EI (total and branch scores), negative affect reactivity, sensory pain, affective pain, and time of immersion. Table 2 shows that people who reported greater negative affect reactivity to the CPT displayed more sensory pain (r = .27, P = .025) and more affective pain (r = .31, P = .012). Negative affect was associated with shorter time of immersion, although the correlation in this case was not significant (r = −.20, P = .099). Total EI score showed a significant negative relationship with negative affect reactivity (r = −.29, P = .018), sensory pain (r = −.25, P = .045), and affective pain (r = −.24, P = .050), but not with time of immersion (r = −09; P = .484). Analysis of EI branches separately showed negative correlations between all branches and negative affect reactivity as well as affective and sensory pain. However, the only statistically significant correlation was between emotional perception and negative affect reactivity (r = −.26, P = .032). The bivariate relationship between sensory pain and affective pain was strong

Table 2. Relationships Among Emotional Intelligence, Pre-Task Negative Affect, Negative Affect During the Task, and Pain-Related Variables

Measure	1	2	3	4	5	6	7	8	9
1. Emotional perception		.44†	.23	.18	.81†	−.26*	−.17	−.18	−.17
2. Emotional facilitation			.21	.23	.66†	−.23	−.04	−.16	−.14
3. Emotional understanding				.11	.60†	−.10	.10	−.22	−.19
4. Managing emotions					.51†	−.15	−.07	−.07	−.12
5. Emotional Intelligence						−.29*	−.09	−.25*	−.24*
6. Negative affect reactivity							−.20	.27*	.31*
7. Time of immersion								−.28*	−.40†
8. Sensory pain									.81†
9. Affective pain									

*$P \le .05$.
†$P \le .01$.

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and positive (r = .81, P = .0001). Finally, negative correlations were found between time of immersion and pain-related variables (sensory pain, r = −.28, P = .023; affective pain, r = −.40, P = .001).

Mediation Analyses

We conducted different mediation analyses to examine whether the relationship between EI and pain-related variables was mediated by negative affect reactivity to the CPT. Following recent recommendations[23] for examining mediation in small samples, we used a nonparametric resampling approach called bootstrapping[30] to test the significance of the hypothesized mediation models. Specifically, using the SPSS Macro provided by Preacher and Hayes,[31] we used the nonparametric resampling method (bias-corrected bootstrap) with 5,000 resamples to derive 95% confidence intervals and thereby examine the statistical significance of the indirect effect of EI on pain-related variables via the hypothesized mediator, negative affect reactivity.[23,30] We carried out mediation analyses separately for sensory pain and for affective pain.

When we analyzed the mediation effect on sensory pain, the indirect effect was estimated to lie between −7.1913 and −.1633 with 95% confidence. Because zero is not in the 95% confidence interval, we can conclude that the indirect effect is significantly different from zero at $P < .05$, and that, as predicted, negative affect reactivity mediates the relationship between EI and sensory pain (see Fig 1). We obtained similar results when we analyzed the mediation effect on affective pain. In this case, the indirect effect was estimated to lie between −8.2632 and −.2671 with 95% confidence. Once again, because zero is not in the 95% confidence interval, we can conclude that negative affect reactivity mediates the effect of EI on affective pain (see Fig 2).

These results are consistent with a model in which negative affect reactivity mediates the relationship between EI and pain perception. However, since our experimental design does not allow us to distinguish whether negative affect leads to greater perceived pain, or whether the painful experience generates greater negative affect, it is conceivable that the direction of causality is reversed, such that subjective experience of pain influences negative affect. To test this alternative model, we conducted a mediation analysis to examine the statistical significance of the indirect effect of EI on negative affect reactivity via the mediators of sensory and affective pain. In this case, the indirect effect was estimated with 95% confidence to lie between −1.2051 and .9250 for sensory pain, and between −2.3837 and .0015 for affective pain. Because the 95% confidence interval includes zero in both cases, we can conclude that these indirect effects are not significantly different from zero at $P < .05$, and these pain-related variables do not mediate the relationship between EI and negative affect reactivity.

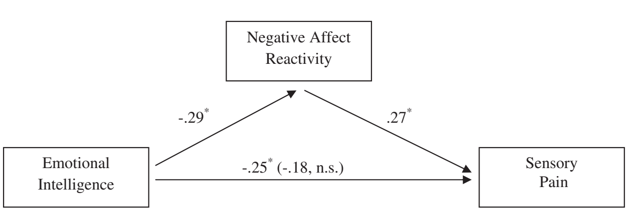

Figure 1. Model of the relationships among emotional intelligence, negative affect reactivity, and sensory pain. Values presented are standardized regression coefficients. The value in parentheses is the coefficient for the indirect (ie, mediated) path.

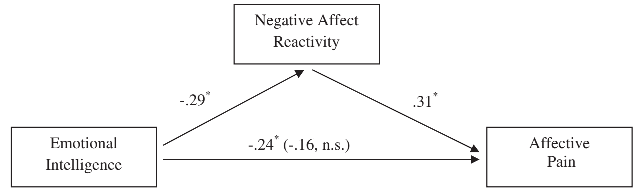

Figure 2. Model of the relationships among emotional intelligence, negative affect reactivity, and affective pain. Values presented are standardized regression coefficients. The value in parentheses is the coefficient for the indirect (i.e., mediated) path.

Discussion

In the present work, we used the CPT to analyze the influence of EI on acute pain. In general, our results suggest that EI is an important element for processing emotional information that accompanies a painful experience. The hypothesis that emotional processing influences subjective perception of pain has been explored in different studies,[18,40] but research has yet to clarify why people with high emotional abilities report less intense pain than others when faced with an experience of acute pain. In the present study we have tried to extend previous work by analyzing the mediating role of negative affect in the relationship between EI, as assessed through a performance measure, and acute pain induced experimentally in a sample of healthy people.

Our results indicate that people with greater negative affect during the task report higher levels of sensory and affective pain. These findings are consistent with previous studies that indicate a relationship between high negative affect and higher perceived pain.[5,39] Different studies in which negative affect was experimentally induced show that participants report an increase in pain experienced.[6,28] However, other studies have found that experimentally induced negative affect influences pain unpleasantness, but not pain intensity.[22] While sensory and affective pain normally show a strong positive correlation, this relationship can vary depending on the type of pain experienced; in addition, different experimental procedures can selectively modify one pain dimension or another.[32] In the present study, both dimensions were affected in the same manner by negative affect generated by the cold pressor experimental task.

In our study, people with greater EI, as evaluated by a performance measure, reported lower negative affect during the task and lower perceived pain. Individual EI branches did not show a significant relationship to pain experience, but they did show a relationship to total EI score. It appears that none of the EI skills by itself can explain the pain experience. This suggests that the combined effect of the various skills grouped under the construct of EI may predict the pain experience better than any of the skills on their own. These results suggest that emotionally intelligent people face stressful and pain-inducing situations in a more effective manner; they use strategies to reduce negative affect and thereby weaken the emotional impact of the task. These people are capable of experiencing stress in a less aversive manner, leading to less suffering and anxiety.

Indeed, our findings support those obtained in other studies showing that people with a greater ability to process emotional information manage more effectively the negative emotions that a stressful situation may cause.[1,10] According to the results of the present study, negative affect mediates the influence of EI on pain perception. Our results are consistent with the idea that people with high EI perceive less pain because they manage to generate less negative affect during the experimental task. In other words, they are able to use the emotional information generated by the task in a more effective manner, reducing negative emotions without repressing or exaggerating the information that they contain. In this way, such individuals demonstrate better understanding of the emotional stimulus. People with high EI feel more in control of their surroundings because they can manage the negative emotions that the experimental task produces in them. It may be that individuals with high EI have greater self-efficacy in managing the distress of pain. These individuals may be setting into motion their emotional abilities, thereby relying on their emotional knowledge.[14] They trust their ability to manage the negative feelings that pain or the stressful situation may provoke, and they believe that emotional influences are under their control. Thus, high EI is not the only thing necessary for handling stressful events; an ability to rely on one's own emotional abilities is also important.

The results of the mediation analysis are consistent with a model in which negative affect mediates the relationship between EI and pain perception. However, it is conceivable that the direction of causality is reversed, such that subjective experience of pain influences negative affect. We assessed the possibility of this reverse directionality using mediation analysis. We found that pain-related variables did not mediate the relationship between EI and negative affect reactivity, which supports our proposed model. Nevertheless, experimental studies provide evidence in favor of an effect of mood on pain. Using emotion-altering procedures (ie, preferred and no preferred music and videos), a number of laboratory studies have assessed the effect of different emotions on pain. They show that changing the emotional state influences pain sensitivity and that the emotional state enhances or decreases perceived pain, depending on whether the valence of the emotion induced is negative or positive, respectively.[22,42,43]

Surprisingly, neither EI nor NA were able to predict time of immersion. This finding is consistent with previous studies.[35] It is possible that the mechanisms responsible for pain tolerance are different from those that allow us to perceive sensory and affective pain. Another possible explanation for this result is gender differences: previous studies have reported gender differences in pain tolerance,[33] and most of the participants in this study were women.

Despite the insights that the present study provides, it does have several limitations. It did not explore the full variety of psychological mechanisms through which EI may influence the experience of pain; further studies with mediation or moderation designs would help to clarify these. This study focused on negative affect, but several other variables can mediate the effect of EI on pain. One such variable is self-efficacy in managing the distress of pain or coping strategy, such as catastrophic thinking and the suppression of thoughts related to the painful experience.[24] Another variable that can moderate the effect of EI on pain is gender: since men and women show different baseline rates of emotional and affective deficits, the experience of pain may differ between the sexes.[3] In fact, most studies have found that women report greater pain than men in experimental tasks that induce acute pain.[21,34] The relatively small proportion of men in our sample means that our results should be applied to the male population with caution. Future studies should increase the proportion of men in the sample and analyze the data for possible gender differences. Lastly, in our study, we did not control for several personal dimensions that may affect the relationship between EI and negative affect, such as cognitive ability and personality.

In future studies, it would be interesting to identify the resources and strategies that emotionally intelligent people use to reduce negative affect, and to analyze the role of positive affect. For example, do people with greater EI maintain high levels of positive affect during an experimental task, which would explain their significantly lower negative affect? Positive emotions have been shown to be important resources in aiding recovery after periods of intense pain.[37] Transitory positive states may be sources of resilience during aversive states. In the end, identifying elements that can reduce the relationship between negative affect and pain is important for the physical and psychological health of people who suffer from chronic pain.

The present study provides insight into how emotional abilities influence negative affect and the experience of pain, which may help to design psychological interventions aimed at increasing these abilities in people with pain-related problems. The development of emotional abilities can work as a preventive therapy to help individuals confront painful events in the future, and it can work as palliative therapy by helping them mitigate the effects of a past painful experience on their mood. Teaching individuals with pain-related problems through EI programs that explicitly engage with, and

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emphasize, emotional abilities of perception, understanding and regulation as defined in the Mayer and Salovey[26] model may therefore be a new avenue to consider for use in the clinic.

Disclosures

This work has not received financial arrangements that may represent a possible conflict of interest.

References

1. Austenfeld JL, Stanton AL: Coping through emotional approach: A new look at emotion, coping and health-related outcomes. J Pers 72:1335-1363, 2004

2. Bishop MD, Craggs J, Horn ME, Robinson ME, George SZ: Relationship of intersession variation in negative pain-related affect and responses to thermally evoked pain. J Pain 11:172-178, 2010

3. Brackett MA, Mayer JD, Warner RM: Emotional intelligence and its relation to everyday behaviour. Person Indiv Diff 36:1387-1402, 2004

4. Carranque GA, Fernández-Berrocal P, Baena Capila E, Bazán Valdez B, Cárdenas Ramos B, Herráiz Salamanca R, Valesco Querino B: Dolor postoperatorio e inteligencia emocional. Rev Esp Anestesiol Reanim 51:75-79, 2004

5. Conrad R, Schilling G, Bausch C, Nadstawek J, Wartenberg HC, Wegener I, Geiser F, Imbierowicz K, Liedtke R: Temperament and character personality profiles and personality disorders in chronic pain patients. Pain 133:197-209, 2007

6. De Wied M, Verbaten MN: Affective pictures processing, attention, and pain tolerance. Pain 20:163-172, 2001

7. Edens JL, Gil KM: Experimental induction of pain: Utility in the study of clinical pain. Behav Ther 2:197-216, 1995

8. Extremera N, Fernández-Berrocal P: Emotional intelligence as predictor of mental, social and physical health in university students. Span J Psychol 9:45-51, 2006

9. Extremera N, Fernández-Berrocal P: Test de Inteligencia Emocional de Mayer Salovey Caruso. Madrid, ES, TEA Ediciones, 2009

10. Fernández-Berrocal P, Extremera N: Emotional intelligence and emotional reactivity and recovery in laboratory context. Psicothema 18:72-78, 2006

11. Fernandez E, Milburn TW: Sensory and affective predictors of overall pain and emotions associated with affective pain. Clin J Pain 10:3-9, 1994

12. Fernandez E, Turk DC: Demand characteristics underlying differential ratings of sensory versus affective components of pain. J Behav Med 17:375-390, 1994

13. Fernandez E, Turk DC: The scope and significance of anger in the experience of chronic pain. Pain 61:165-175, 1995

14. Gohm CL, Corser GC, Dalsky DJ: Emotional intelligence under stress: Useful, unnecessary, or irrelevant? Person Indiv Diff 39:1017-1028, 2005

15. Goldenber I, Matheson K, Mantler J: The assessment of emotional intelligence: A comparison of performance-based and self-report methodologies. J Pers Assess 86: 33-45, 2006

16. Goldman SL, Kraemer DT, Salovey P: Beliefs about mood moderate the relationships of stress to illness and symptom reporting. J Psychosom Res 41:128-155, 1996

17. International Association for the Study of Pain: Committee on Ethical Issues, Ethical Guidelines for Pain Research in Humans. Pain 63:277-278, 1995

18. Keefe FJ, Lumley M, Anderson T, Lynch T, Carson K: Pain and emotion: New research directions. J Clin Psychol 57: 587-607, 2001

19. Keogh E, Hatton K, Ellery D: Avoidance versus focused attention and the perception of pain: Differential effects for men and women. Pain 85:225-230, 2000

20. Keogh E, Mansoor L: Investigating the effects of anxiety sensitivity and coping on the perception of cold pressor pain in healthy women. Eur J Pain 5:11-25, 2001

21. Logan H, Gedney J: Sex differences in the long-term stability of forehead cold pressor pain. J Pain 5:406-414, 2004

22. Loggia ML, Mogil JS, Bushnell MC: Experimentally induced mood changes preferentially affect pain unpleasantness. J Pain 9:784-791, 2008

23. MacKinnon DP, Lockwood CM, Williams J: Confidence limits for the indirect effect: Distribution of the product and resampling methods. Multivariate Behav Res 39: 99-128, 2004

24. Masedo AI, Esteve MR: Effects of suppression, acceptance and spontaneous coping on pain tolerance, pain intensity and distress. Behav Res Ther 45:199-209, 2007

25. Mayer JD, Roberts RD, Barsade SG: Human abilities: Emotional intelligence. Annu Rev Psychol 59:507-536, 2008

26. Mayer JD, Salovey P: What is emotional intelligence? in Salovey P, Sluyter D (eds): Emotional Development and Emotional Intelligence: Implications for Educators. New York, NY, Basic Books, 1997, pp 3-31

27. Mayer JD, Salovey P, Caruso D: Mayer-Salovey-Caruso Emotional Intelligence Test (MSCEIT) user manual. Toronto, Canada, MHS, 2002

28. Meagher MW, Arnau RC, Rhudy JL: Pain and emotion: Effects of affective picture modulation. Psychosom Med 63:79-90, 2001

29. Melzack R, Wall P: Pain mechanisms: A new theory. Science 19:971-979, 1965

30. Preacher KJ, Hayes A: SPSS and SAS procedures for estimating indirect effects in simple mediation models. Behav Res Methods Instrum Comput 36:717-731, 2004

31. Preacher KJ, Hayes A: SPSS and SAS macros for bootstrapping indirect effects in multiple mediator models. Available at: http://www.comm.ohio-state.edu/ahayes/SPSS%20programs/indirect.htm Accessed 2009

32. Rainville P, Carrier B, Hofbauer RK, Bushnell MC, Duncan GH: Dissociation of sensory and affective dimensions of pain using hypnotic modulation. Pain 82:159-171, 1999

33. Riley JL, Robinson ME, Wise EA, Myers CD, Fillingim RB: Sex differences in the perception of noxious experimental stimuli: A meta-analysis. Pain 74:181-187

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34. Robinson ME, Dannecker EA, George SZ, Otis J, Atchison JW, Fillingim RB: Sex differences in the associations among psychological factors and pain report: A novel psychophysical study of patients with chronic low back pain. J Pain 6:463-470, 2005

35. Ruiz-Aranda D, Salguero JM, Fernández-Berrocal P: Emotional regulation and acute pain perception in women. J Pain 11:564-569, 2010

36. Sandin B, Chorot P, Lostao L, Joiner TE, Santed MA, Valiente RM: Escalas Panas de afecto positivo y negativo: Validación factorial y convergencia transcultural. Psicothema 11:37-51, 1999

37. Strand EB, Zautra AJ, Thoresen M, Ødegård S, Uhlig T, Finset A: Positive affect as a factor of resilience in the pain-negative affect relationship in patients with rheumatoid arthritis. J Psychosom Res 60:477-484, 2006

38. Van Middendorp H, Lumley MA, Jacobs JWG, Van Doornen LJP, Bijisma JWJ, Geenen R: Emotions and emotional approach and avoidance strategies in fibromyalgia. J Psychosom Res 64:159-167, 2008

39. Velasco L, Zautra AJ, Peñacoba C, López A, Barjola P: Cognitive-affective assets and vulnerabilities: Two factors influencing adaptation to fibromyalgia. Psychol Health 25: 197-212, 2008

40. Villemure C, Slotnick BM, Bushnell MC: Effects of odors on pain perception: Deciphering the roles of emotion and attention. Pain 106:101-108, 2003

41. Watson D, Clark L, Tellegen A: Development and validation of brief measures of positive and negative affect: The PANAS scales. J Pers Soc Psychol 54:1063-1070, 1988

42. Weisenberg M, Raz T, Hener T: The influence of film induced-mood on pain perception. Pain 76:365-375, 1998

43. Whipple B, Glynn NJ: Quantification of the effects of listening to music as a noninvasive method of pain control. Sch Inq Nurs Pract 6:43-58, 1992

44. Wiech K, Tracey I: The influence of negative emotions on pain: Behavioral effects and neural mechanisms. NeuroImage 47:987-994, 2009

45. Wolff BB: Methods of testing pain mechanisms in normal man, in Wall PD, Melzack R (eds): Textbook of Pain. Edinburgh, UK, Churchill Livingstone, 1984, pp 186-194

46. Zautra AJ, Smith BW: Depression and reactivity to stress in older women with rheumatoid arthritis and osteoarthritis. Psychosom Med 63:687-696, 2001

47. Zelman DC, Howland EW, Nichols SN, Cleeland CS: The effects of induced mood on laboratory pain. Pain 46: 105-111, 1991