

# Effects of suppression, acceptance and spontaneous coping on pain tolerance, pain intensity and distress

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## Abstract

Wegner's Theory of Ironic Processes has been applied to study the effects of cognitive strategies to control pain. Research suggests that suppression contributes to a more distressing pain experience. Recently, the acceptance-based approach has been proposed as an alternative to cognitive control. This study assessed the tolerance time, the distress and the perceived pain intensity in three groups (suppression, acceptance and spontaneous coping groups) when the participants were exposed to a cold pressor procedure. Two hundred and nineteen undergraduates volunteered to participate. The suppression group showed the shortest tolerance time and the acceptance group showed the longest tolerance time. The acceptance group showed pain and distress immersion ratings that were significantly lower than in the other two groups, between which the differences were not significant. In the first recovery period, the suppression group showed pain and distress ratings that were higher than in the other two groups. In the second recovery period, although the acceptance group showed pain and distress ratings that were significantly lower than in the other two groups, the suppression and the spontaneous coping groups did not differ. The presence of a 'rebound' of physical discomfort and the effects of suppression on behavioural avoidance are discussed. These results support the acceptance approach in the management of pain.

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## Introduction

In western culture, distraction is a commonsense strategy to control pain, and 'attention diversion training' is an important element in most types of cognitive behavioural therapy. Nevertheless, the effectiveness of distraction in the control of pain is still a controversial matter (Goubert, Crombez, Eccleston, & Devulder, 2004; Roelofs, Peters, Van der Zijden, & Vlaeyen, 2004) and the results from clinical and experimental research are inconclusive (Ahles, Blanchard, & Leventhal, 1983; Cioffi, 1991; Elliot & Eccleston, 2003; Hodes, Howland, Lightfoot, & Cleeland, 1990; Leventhal, 1992; McCaul & Malott, 1984; Morley, Shapiro, & Biggs, 2003; Turk, Meichenbaum, & Genest, 1983).

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Wegner (1994) contemplated thought suppression research to shed light on the contradictory results relating to the relative effectiveness of two cognitive strategies to control pain: attention to or distraction from the pain. Wegner, Schneider, Carter, and White (1987) demonstrated that when participants had been instructed to suppress neutral thoughts, they had more frequent thought occurrences compared with when they had been asked to express the thought ('immediate enhancement effect'). Also, a 'rebound effect' was found, in which those who were initially asked to suppress a thought experienced that thought more frequently during a subsequent expression period compared with those who first expressed and then suppressed the thought. The Theory of Ironic Processes (Wegner, 1992, 1994) suggests that this increase of thoughts could be explained by the action of two opposing processes: an intentional operating process that searches for the mental contents that will yield the desired state; and an ironic monitoring process that searches for mental contents that signal the failure to achieve the desired state. Under mental load, the operating process will be limited and the monitoring process that searches for thoughts or sensations that are indicative of failed control will take them into consciousness. Nevertheless, based on an extensive review of more than a decade of research, Purdon (1999) concluded that the results of the studies investigating the paradoxical effects of suppression on frequency of neutral and clinically relevant thoughts have been highly inconsistent. The effects of suppression have also been studied in relation to discomfort and mood state (Koster, Rassin, Crombez, & Näring, 2003; Purdon & Clark, 2001; Purdon, Rowa, & Antony, 2005; Trinder & Salkovskis, 1994). Some found that suppression of obsessional thoughts was associated with greater discomfort and more negative mood state than suppression of positive or neutral thoughts, although they did not find paradoxical effects of suppression on the frequency of any type of thought (Purdon & Clark, 2001; Purdon, Rowa, & Antony, 2005). Purdon and Clark (2001) have argued that the discomfort that is associated with thought suppression should be the target of inquiry rather than the frequency of thoughts.

Cioffi and Holloway (1993) were the first to apply the Theory of Ironic Processes (Wegner, 1992, 1994) to the study of pain and found supportive evidence that subjects who are experiencing laboratory pain indicated greater pain perception with suppression than with distraction and/or monitoring. The target in their study was not a particular thought, but the experience of discomfort itself, and their results showed that the 'rebound' effect of thought suppression had an analogue in the subjective experience of somatic discomfort.

Sullivan, Rouse, Bishop, and Johnston (1997) found that participants who were asked to suppress their thoughts about an upcoming pain procedure experienced more thought intrusions during the suppression period, and experienced more pain during the ice-water immersion than participants who were not given suppression instructions.

Harvey and McGuire (2000) studied the effects of suppression of pain-related thoughts in a clinical sample. They found that the suppression instructions did not increase pain-related thoughts and that the subjects in the attention to pain condition showed more pain-related thoughts than the subjects in the suppression group. The authors explained that these unexpected results occurred as pain is primarily a physical sensation, and therefore could be less easily conceptualized as a discrete cognitive event. Harvey and McGuire (2000) proposed that future research should assess the effects of suppression of pain-related sensations rather than pain-related thoughts. Following this suggestion and in line with previous research (Cioffi & Holloway, 1993), the present study assessed the experience of discomfort itself as the target of suppression; pain was taken as a whole—that is, a complete experience comprising thoughts, emotions and sensations.

The best example of a therapeutic technique involving the suppression of unwanted thoughts is 'thought-stopping' (Wolpe & Lazarus, 1966), which is widely used and recommended in professional therapy (Druckman & Bjork, 1994). In order to favour the generalization to clinical practice, it is appropriate to test the effects of suppression instructions based on a specific therapeutic technique; therefore, the present study examined the effects of 'thought-stopping' on the tolerance time and on the distress when the participants were exposed to a painful procedure. As mentioned previously, the suppression instructions were directed not only to pain-related thoughts but also to pain-related sensations and emotions.

It is also interesting to compare the effects of suppression with the effects of alternative strategies. Goubert et al. (2004) suggested that acceptance-based protocols may be a promising alternative for attentional management of pain. A recent experimental study compared three groups—thought suppression, acceptance and monitoring-only—in relation to the frequency and distress associated with experiencing personally relevant intrusive thoughts (Marcks & Woods, 2005). Acceptance approaches seek to undermine the linkage

between private events and overt behaviour, rather than attempting to control the form or frequency of private events (Hayes, Strosahl, & Wilson, 1999). Acceptance-based interventions attempt to teach clients to feel emotions and bodily sensations more fully and without avoidance, and to notice fully the presence of thoughts without following, resisting, believing or disbelieving them. Marcks and Woods (2005) found that those instructed to suppress their personal intrusive thoughts were unable to do so and experienced an increased level of distress after suppression, whereas those instructed to use an acceptance-based strategy experienced a decrease in discomfort level (but not thought frequency) after having used such a strategy. In the field of pain, Hayes et al. (1999) and Korn (1997) examined the behavioural and subjective impact of a control-based versus an acceptance rationale, using a cold pressor task. Subjects in the acceptance group demonstrated greater tolerance of pain compared with the control-based and placebo groups. The three groups did not differ in the measures related to the subjective experience of pain.

Gutiérrez, Luciano, Rodríguez, and Fink (2004) using electric shocks, found that the acceptance group showed significantly higher tolerance to pain compared to the control-based intervention group. Further, the control intervention produced a greater reduction in self-reported measures of pain.

The present study compared the effects of suppression—‘thought-stopping’—with the effects of an acceptance-based intervention on tolerance time and on the distress and the perceived pain intensity when the participants were exposed to a cold pressor procedure. The suppression and the acceptance instructions were directed not only to pain-related thoughts but also to pain-related sensations and emotions. Furthermore, it is important to compare the effects of these alternative interventions with the effects of the coping strategies that the participants spontaneously use. It is a well-known fact that, in experimental studies, participants report spontaneously using a wide range of coping strategies to help them endure the noxious sensations that they experience (Turk, Meichenbaum, & Genest, 1983). It has been argued that this condition is not of sufficient interest to warrant carrying out studies (Cioffi & Holloway, 1993); nevertheless, it must be demonstrated that, on average, the psychologically structured techniques are superior to the strategies that the individuals apply by themselves.

It was predicted that subjects in the suppression group, in comparison with subjects in the acceptance and the spontaneous coping groups, would show a shorter tolerance time and higher pain and distress ratings. Furthermore, subjects in the acceptance group are expected to show a longer tolerance time and lower pain and distress ratings than subjects in the spontaneous coping group.

## Method

### *Participants*

Two hundred and nineteen psychology undergraduates volunteered to participate in exchange for course credits. The research project—of which this study is a part—was approved by the Carlos Haya Hospital Ethics Committee. Informed consent was obtained prior to data collection. The subjects were aware of the experimental procedure and of their right to withdraw from the study at any time without penalty.

Participants were excluded if the following medical problems were present: an existing pain condition, history of heart disease, high blood pressure, recent injuries or circulatory disorders. Seventeen subjects were excused to participate in the study for one of these reasons.

One-hundred and sixty-four subjects who were able to keep their hand in the ice-water for 5 min during the first cold pressor task in the screening session were excused from further participation in the study. Several authors (Hayes, Bisset, et al., 1999; Heyneman, Fremouw, Gano, Kirkland, & Heiden, 1990) advised use of this screening procedure to increase the power of the experimental intervention, which was meant for individuals who were unable to tolerate pain readily, and also for safety reasons to avoid excessive exposure to the cold water. The exclusion rate (42.81%) was similar to the one (58%) reported by Hayes, Bisset, et al. (1999). The participants excluded in the screening session were similar to the final sample in the distribution of sexes (44.44% male and 55.66% female) and the mean age ( $M = 19.93$ ,  $SD = 3.01$ ).

The final sample was made up of 219 participants (47.9% males and 52.1% females) that were divided into three groups using a randomized block design. Each of the three cells was designed to have approximately 48% males and 52% females. The mean age was 20 years ( $SD = 2.97$ ).

## *Apparatus*

The cold pressor apparatus consisted of two metal containers that were approximately 50 × 30 × 30 cm in size. One of the containers was filled with water at room temperature (approximately 21 °C). The other container was divided into two sections by a wire screen. It was filled with water and the ice was placed on one side of the wire screen, with the subjects' hand and forearm immersed in the other, ice-free side. The water was maintained at 2–4 °C and was kept circulating by a pump during the immersion. Water temperature was measured using a digital thermometer that was immersed into the water and fixed to the container. During testing, the participants were seated in a comfortable chair adjacent to the container and they rested their non-dominant arm in a cradle support.

The range of 2–4 °C was considered appropriate for the purpose of the present study. Lower temperatures—0–2 °C—are frequently used to provoke more intense pain, and numbing effects usually appear quickly. Nevertheless, the temperature of 2–4 °C allows longer tolerance times and the participants have enough time to put into action the strategies in which they have been trained.

## *Measures*

### *Dependent variables*

Cold pressor stimulation allows two types of response measures to occur: ratings of pain and distress at fixed time intervals and the subject's tolerance time. The following measures were taken at the baseline period and at the post-intervention period.

*Tolerance.* Tolerance time is the length of time that the hand and forearm is under the cold water. The seconds of immersion were recorded using a digital stopwatch.

*Pain immersion ratings.* Subjective pain was assessed by a rating scale (displayed in front of the subject during the cold pressor) with the endpoints (0) indicating 'no pain' and (10) indicating 'the worse pain'. Patients were asked 'how much pain do you feel at the moment?' All the ratings for each 30-s period were added together and this sum was divided by the number of the ratings collected for each subject. This ratio was calculated because the single sum of ratings could lead to errors as the participants with longer tolerance times would have a higher sum of ratings of pain and distress. The contrary is also true: the subjects with shorter tolerance times would show the lowest pain and distress ratings simply because their hands have stayed in the water for shorter periods in which they could report on their pain.

*Distress immersion ratings.* Subjective distress was assessed by a rating scale (displayed in front of the subject during the cold pressor) with the endpoints (0) indicating 'no distress' and (10) indicating 'the worse distress'. Patients were asked 'how distressed are you at the moment by the pain in your arm?' An index of distress was also constructed by adding all the distress ratings for each 30-s period and dividing this sum by the number of ratings collected for each subject.

*Pain recovery ratings.* Pain ratings were taken in two periods of 30 s after the subjects removed their arm from the ice water. Therefore, there were two scores, one for each period of recovery: period 1, 30 s after the participants took their hands out of the water; and period 2, 60 s after the participants took their hands out of the water.

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### Independent variables

*Acceptance, spontaneous coping and suppression trainings.* Each intervention lasted for approximately 20 min and was scripted word by word. These interventions consisted of a brief theoretical explanation, description of examples and brief exercises. Two therapists, blind to the hypothesis, were previously trained and participants were taught individually.

*Acceptance.* This group was asked to accept, observe and not control pain-related sensations, emotions and thoughts. This training was based on the acceptance rationale of the *Acceptance and Commitment Therapy* (Hayes, Bisset, et al., 1999; Hayes, Strosahl, et al., 1999). Its basic elements are:

- It is often impossible to get rid of ‘bad’ feelings and thoughts by directly trying to do so (i.e. ‘do not think of the pain’ may cause thoughts of pain).
- Control is the problem and leads to unworkable outcomes through emotional avoidance and escape.
- Thoughts, feelings and sensations are not the same as ‘who we are’. We can observe them and distinguish us from them (exercise ‘Practicing awareness of your experience’).
- Thoughts, feelings and sensations are often viewed as reasons for behaviour, but they neither cause nor justify behaviour (‘Passengers on the Bus Exercise’).
- Willingness is an alternative to control (The ‘Two Scales Metaphor’ was narrated).
- Finally, the experimenter applied the previous principles to the cold pressor situation and asked the participants to do so in the next cold pressor task.

*Spontaneous coping.* The participants in this group received an educational presentation on the types and components of pain. This experimental condition consisted of a brief explanation about the psychological factors that influence pain. Although any specific strategy was trained, participants were asked to apply the previous explanations to cope with pain (thoughts, emotions and sensations) in the upcoming cold pressor procedure.

*Suppression.* Participants were required to suppress any pain-related emotions, thoughts and sensations. They were not asked to distract themselves from pain by thinking about something or someone else. Salkovskis and Campbell (1994) differentiated between simple suppression instructions, suppression with general instructions to distract, suppression with general ‘do not distract’ instructions and suppression supplemented with a competing and engaging task. ‘Pure’ suppression instructions were used in this study because, as Wegner and Wenzlaff (1996) emphasized, distraction should be distinguished from suppression per se because ‘compound strategies’—such as suppression plus distraction—can have different influences.

The training instructions were based on ‘thought-stopping’ (Wolpe & Lazarus, 1966), which is a therapeutic technique involving the suppression of unwanted thoughts and that it is widely used and recommended in professional therapy. Thought-stopping involves recognizing an inappropriate thought (emotion and sensation) and (silently) yelling ‘STOP’ then breathing deeply and exhaling slowly. Thought-stopping was trained first in relation to a neutral situation (going for a walk with a friend) and, second, in relation to the cold pressor task. In both cases the procedure was as follows:

- The participant was asked to imagine the situation.
- One thought was targeted for suppression (‘it was rainy’).
- The participant imagined the situation again and was instructed to raise his/her right hand when the thought was present.
- The experimenter interrupted the thought by yelling ‘stop’.
- The participant was instructed to suppress the target thought by (silently) yelling ‘stop’.
- The participant imagined the situation again and silently suppressed the target thought.

When thought-stopping was trained in relation to the cold pressor task, the same steps were followed and three thoughts were targeted: ‘It hurts a lot’, ‘it is unbearable’ and ‘I am getting nervous’. The participants in this group were asked to suppress these thoughts in the upcoming cold pressor using the thought-stopping technique.

## Procedure

*Screening session:* Immediately following informed consent and prior to entering the laboratory, each participant was interviewed to exclude those who presented the aforementioned medical contra-indications to the procedure. Then, non-excluded participants underwent a cold pressor test.

Participants were told that the purpose of the study was to examine factors that influence the experience of discomfort and pain. As in previous studies (for example, Dar & Leventhal, 1993; Turk et al., 1983), the cold pressor proceeded as follows:

- Participants were shown the ice-water immersion apparatus and were instructed about the procedure.
- To regulate the hand and forearm temperature, each participant immersed their non-dominant arm for 5 min in the container filled with room-temperature water.
- They were then asked to introduce their non-dominant arm into the cold-water container and they received the instruction to be free to terminate the exposure at any time they wished.

The experimenter used a stopwatch to measure the tolerance time. As previously mentioned, to increase the power of the experimental intervention and for safety reasons, there was a limit of 5 min for the immersion. The participants were not informed of this ceiling in an attempt to reduce the risk of competitiveness and to limit any misconceptions that the hand was expected to be submerged in the cold water for that specific length of time. All the participants were told that they would be appointed by telephone for another session but, as mentioned, those who had their hand in the ice water for 5 min were not called for the next experimental session. The data on tolerance time of this session was not taken into account in later analyses.

*Experimental session:* Approximately 1 week following the screening session, the experimental session took place and was developed as follows:

- *Baseline cold pressor:* The participants again underwent the cold pressor. The only difference with the above-described procedure was that they were instructed to report on their perceptions of pain and distress at 30-s intervals as they immersed their non-dominant arm in the ice water until 60 s after they took their arm out of the cold water. The subjects were asked to report aloud their pain and distress ratings and these were then recorded by the experimenter. The order of the pain and distress reports was counterbalanced.
- *Intervention:* The subjects were trained in each experimental condition. The three conditions had the same duration (20 min). Approximately the same number of subjects (71 acceptance, 74 suppression and 74 spontaneous coping) were assigned to each condition. According to Cohen (1988), the size of the experimental groups gives a high power to the analysis (0.99) to detect medium-size effects (0.30) at a 0.05 significance level with two degrees of freedom.
- *Post-intervention cold pressor:* The subjects participated again in a cold pressor task that was procedurally identical to that at baseline.

When all the subjects had participated in the experiment, the experimenter explained, in a group session, the purpose and design of the study and apologized to the subjects who had been excluded and who also received course credits, although they did not take part in all the sessions.

## Results

Prior to analysis, the variables were examined for accuracy of data entry. According to the Kolmogorov–Smirnov test, the variables were normally distributed.

To assess the effect of the experimental manipulation, a one-way ANCOVA was conducted to determine whether the three groups differed in the dependent variables after the intervention procedure, which controlled for their baseline scores that were used as covariates.

### *Tolerance*

Results showed significant group differences in tolerance after the intervention,  $F(2215) = 9.96, p < 0.001$ . Controlling for baseline tolerance, subsequent paired comparisons showed that the suppression group ( $M = 137.26, SD = 110.95$ ) showed a tolerance time that was significantly ( $p < 0.05$ ) shorter than that of the spontaneous coping group ( $M = 184.22, SD = 112.60$ ) and the acceptance group ( $M = 220.20, SD = 104.82$ ); in addition, the acceptance group showed a tolerance time that was significantly higher than that of the spontaneous coping group.

### *Pain immersion ratings*

After controlling for baseline pain ratings, a significant difference was found between the groups,  $F(2215) = 3.27, p < 0.05$ . Paired comparisons showed that pain ratings were significantly lower ( $p < 0.05$ ) in the acceptance group ( $M = 5.40, SD = 2.09$ ) than in the suppression group ( $M = 6.28, SD = 1.96$ ) and the spontaneous coping group ( $M = 6.11, SD = 2.10$ ); nevertheless, these two conditions did not significantly differ.

### *Distress immersion ratings*

Results showed significant group differences in distress ratings after controlling for baseline ratings,  $F(2215) = 5.85, p < 0.01$ . Distress ratings were significantly lower ( $p < 0.05$ ) in the acceptance group ( $M = 4.96, SD = 2.21$ ) than in the other two groups. The suppression ( $M = 5.88, SD = 2.34$ ) and the spontaneous coping groups ( $M = 5.77, SD = 2.55$ ) did not significantly differ.

### *Pain recovery ratings*

Period 1 (30 s after the participants took their hands out of the water). When controlling for baseline pain recovery ratings, significant group differences were found,  $F(2215) = 13.20, p < 0.001$ . Subsequent paired comparisons showed that the suppression group ( $M = 6.08, SD = 2.53$ ) showed pain recovery ratings that were significantly ( $p < 0.05$ ) higher than those in the acceptance group ( $M = 4.32, SD = 2.72$ ) and the spontaneous coping group ( $M = 5.38, SD = 2.61$ ). In addition, the acceptance group and the spontaneous coping group were significantly different in the predicted direction.

Period 2 (60 s after the participants took their hands out of the water). When controlling for baseline pain recovery ratings, significant group differences were found,  $F(2215) = 6.17, p < 0.005$ . Subsequent paired comparisons showed that the suppression group ( $M = 4.15, SD = 2.52$ ) showed pain recovery ratings that were significantly ( $p < 0.05$ ) higher than those in the acceptance group ( $M = 3.23, SD = 2.41$ ). In addition, the spontaneous coping group ( $M = 3.97, SD = 2.80$ ) showed pain recovery ratings that were significantly ( $p < 0.05$ ) higher than those in the acceptance group; the spontaneous coping and the suppression groups did not differ significantly.

### *Distress recovery ratings*

Period 1 (30 s after the participants took their hands out of the water). Results showed significant group differences in distress recovery ratings after controlling for baseline ratings,  $F(2215) = 13.99, p < 0.001$ . Distress recovery ratings were significantly lower ( $p < 0.05$ ) in the acceptance group ( $M = 3.73, SD = 2.62$ ) than they were in the other two groups. The spontaneous coping ( $M = 4.71, SD = 2.87$ ) and the suppression groups ( $M = 5.39, SD = 2.88$ ) were significantly different in the predicted direction.

Period 2 (60 s after the participants took their hands out of the water). When controlling for baseline distress recovery ratings, significant group differences were found,  $F(2215) = 7.52, p < 0.001$ . Subsequent paired comparisons showed that distress recovery ratings were significantly lower ( $p < 0.05$ ) in the acceptance group ( $M = 2.61, SD = 2.28$ ) than they were in the other two groups. The spontaneous coping group ( $M = 3.42, SD = 2.62$ ) and the suppression group ( $M = 3.49, SD = 2.73$ ) did not differ significantly.

## Discussion

The aim of this study was to compare the effects of three alternative approaches directed at the management of pain: suppression by a specific therapeutic technique, the ‘thought stopping’ approach; an acceptance-based intervention; and the coping strategies that the participants spontaneously use. Participants were trained in one of these conditions and applied the learned strategies when they were exposed to a painful procedure.

According to our hypotheses, the acceptance group showed a tolerance time that was significantly longer than that of the other experimental groups. This finding agreed with the results of Hayes, Bisset, et al. (1999) and Korn (1997), who found that the acceptance group demonstrated greater tolerance of pain compared with the control-based and the placebo groups. This is an expected result because the acceptance approach explicitly targeted behaviour; thoughts and feelings are ruled out as causes of behaviour, and the subjects are urged to give up their control and to behave in a valued direction. To paraphrase Hayes, Wilson, Gifford, Follette, and Strosahl (1996), acceptance means actively contacting physical and psychological experiences while behaving effectively. The clinical implications are important in the field of pain in which the avoidant behaviours often lead to disability and social isolation. Acceptance requires that an individual maintains functioning and participates in the activities of daily life even while continuing to experience pain (McCracken, Vowles, & Eccleston, 2004; Risdon, Eccleston, Crombez, & McCracken, 2003). Furthermore, the association of pain acceptance with less disability is a consolidated finding (McCracken, 1998, 1999; McCracken & Eccleston, 2003; McCracken, Spertus, Janneck, Sinclair, & Wetzel, 1999; McCracken, Vowles, & Eccleston, 2005; Viane et al., 2003).

On the other hand, it was found that the suppression group showed a tolerance time that was shorter than those in other experimental groups. In this sense, it can be concluded that suppression—applied to pain thoughts, sensations and emotions—is a strategy that also promotes behavioural avoidance. Cioffi and Holloway (1993) did not find that suppression produced shorter tolerance times compared with distraction and monitoring. These contradictory results could be explained by differences in the experimental procedure, as the subjects received ‘instructions’ that lasted for 60 s; the participants in the present study received a ‘training’ that lasted for approximately 20 min, and they practiced the taught strategies. Also, it must be taken into account that in this study, to favour the clinical generalization of our findings, the suppression instructions took the form of a specific therapeutic technique. On the other hand, ‘monitoring’ is just an element of the acceptance approach, but it cannot be reduced to it.

Overall, it can be said that the cold pressor was a less distressing experience for the acceptance group. In this study, as well as a higher tolerance time, the participants in the acceptance group reported less pain and distress during the immersion and the recovery periods than did the participants in the other experimental groups. As was mentioned previously, Korn (1997) and Hayes, Bisset, et al. (1999) found that the acceptance training produced longer tolerance times; nevertheless, they did not find differences between the groups in the subjective measures of sensation, pain and unpleasantness. The authors suggested that the synchrony between feelings and overt behaviour was influenced by the acceptance rationale. The divergent results can be due to procedural differences. In the present study, the acceptance approach is compared with a suppression procedure. Nevertheless, Hayes, Bisset, et al. (1999) compared acceptance with a control-based rationale based on a coping skills and stress inoculation approach to pain, which could be more effective than ‘pure’ suppression in relation to pain perception. Interestingly, Gutiérrez et al. (2004) found that the participants in the control condition showed greater tolerance to pain when the level of pain reported was low, whereas participants in the acceptance condition continued performing the pain task and showed greater pain tolerance even when they reported experiencing more pain. These results supported the capacity of the acceptance intervention to break the synchrony between private reactions to pain and other pain behaviours. Nevertheless, in the light of these contradictory results, and taking into account that there are important procedural differences between the studies, the question about the relationship between tolerance and self-reported pain remains open for future research.

On the other hand, during the immersion period there were no differences in pain and distress ratings between the suppression and the spontaneous coping group, but in the first recovery period, when the suppression process was removed, a ‘rebound’ of pain and distress was found and the suppression group showed higher pain and distress ratings than in the other two groups. This difference vanished in the second

recovery period. Cioffi and Holloway (1993) also found a ‘rebound’ of physical discomfort after the cold pressor exposure during a 2-min recovery period. Their results showed that the participants who suppressed their cold pressor sensations recovered from their discomfort more slowly than did people who used distraction during the cold pressor exposure, and those who monitored their sensations recovered more rapidly. Sullivan et al. (1997) emphasized that the findings that thought suppression leads to a heightened pain experience indicates that the consequences of suppression are apparent even with processes—such as cognitive, affective and somatic—that are not directly linked to the target of suppression. In agreement with our results, Marcks and Woods (2005) also found a ‘rebound’ of distress after suppression of personal intrusive thoughts, whereas those instructed to use an acceptance-based strategy experienced a decrease in discomfort level after having used such a strategy. Nevertheless, as previously mentioned, it must be noted that the ‘rebound’ effect found in the present study was only apparent in the first 30-s period. Sullivan et al. (1997) also only found the effects of suppression for pain ratings following the first 20-s period of immersion. They suggested that the differential effect of suppression could be explained by changes in the subjective intensity of the pain stimulus that depends on the time of stimulus exposure. They postulated that when the adversity of the sensory experience is higher, the influence of non-sensory information may be lower. Future research should study the role of all the factors that could be involved in the effects of suppression on subjective pain reports.

In summary, as predicted, the suppression group, in comparison with the acceptance and the spontaneous coping groups, showed a shorter tolerance time and a slower recovery. Contrary to predictions, however, they did not differ from the spontaneous coping group in pain and distress ratings during the immersion and in the second recovery period. As mentioned, the spontaneous coping group was included in the study design because it was considered relevant to contrast the effectiveness of structured psychological techniques with the strategies that were spontaneously used by the participants. It can therefore be concluded that suppression is not worse than the spontaneous coping strategies, at least in relation to pain and distress during the cold pressor procedure. A posteriori analyses showed that the participants in the spontaneous coping group applied a wide array of strategies, mainly changing the position of the hand, keeping the hand motionless, relaxation and distraction. Regardless of the concrete strategies applied, both conditions share their emphasis on the control of pain and, in this sense, they could be considered ‘avoidant’ attitudes as opposed to an alternative accepting attitude, which implies the relinquishment of needing to control one’s thoughts and feelings (Hayes & Wilson, 1994). It is important to emphasize that acceptance does not mean substituting ‘control’ for ‘no-control’; acceptance means to change the target for control from uncontrollable events (pain itself) to controllable factors—that is, behaviour change entailing better daily function despite pain (Hayes, Strosahl, et al., 1999).

This study has several limitations. First, the ability to generalize the results is limited as, in the present study, only brief portions of psychological interventions are applied. Marcks and Woods (2005) emphasized that creating effective acceptance-based procedures can be particularly difficult, as acceptance cannot be manipulated through simple instructions, but rather it must be done experientially. The same could be applicable to ‘thought-stopping’, in which some research shows that suppression performance benefits from practice and that as individuals suppress thoughts, they can do it more effectively (LoSchiavo, 1996). Also, in generalizing the results of the present study, we must consider that ‘suppression’ has been conceptualized as merely ‘prohibiting’ pain-related sensations, thoughts and emotions rather than allowing concentration on something else. On the other hand, the relevance of applying suppression using a well-known psychological technique, ‘thought-stopping’, must be emphasized.

Furthermore, this study was conducted with undergraduates. Therefore, caution should be heeded in generalizing these results to both other non-clinical populations and clinical populations until these effects are examined more extensively.

Another limitation involves the ceiling of 5 min in the cold pressor task, which prevented some subjects from reaching their limit of pain tolerance; consequently, group differences in this variable are likely to be even greater than those obtained. Future research should also explicitly assess the specific thoughts and strategies that are used by the subjects, either utilizing a talk-aloud procedure or a pencil-and-paper assessment.

Despite the aforementioned limitations, the results clearly showed the superiority of the acceptance approach in the management of pain. This group endured the pain for longer, expressed less pain and distress during the cold pressor task and recovered more quickly after exposure. The findings lend support to the

acceptance approach as a promising therapeutic alternative for the attentional management of pain. It can be concluded that attention to pain (in the form of acceptance) works better than distraction (in the form of ‘thought stopping’). The therapeutic approaches that promote acceptance as opposed to control of pain seem to be particularly appropriate for patients who have chronic pain; therefore, clinicians should focus on reducing patients’ avoidance- and emotion-orientated coping styles (Hayes, Strosahl, et al., 1999). Finally, several studies found that the effect of distraction on the pain experience was a function of personal characteristics, such as pain catastrophizing, anxiety and fear of pain (Hadjistavropoulos, Hadjistavropoulos, & Quine, 2000; Heyneman et al., 1990; Keogh & Mansoor, 2001; Roelofs et al., 2004). Therefore, future research should investigate the role of individual differences, particularly in relation to the effects of acceptance approaches. Such research would contribute to efficacy by customizing the treatment for chronic-pain patients (Turk, 1990; Vlaeyen & Morley, 2005).

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## References

- Ahles, T., Blanchard, E., & Leventhal, H. (1983). Cognitive control of pain: Attention to the sensory aspects of the cold pressor stimulus. *Cognitive Therapy and Research*, 7, 159–177.
- Cioffi, D. (1991). Sensory awareness versus sensory impression: Affect and attention interact to produce somatic meaning. *Cognition and Emotion*, 5, 275–294.
- Cioffi, D., & Holloway, J. (1993). Delayed costs of suppressed pain. *Journal of Personality and Social Psychology*, 64, 274–282.
- Cohen, J. (1988). *Statistical power analysis for the behavioral sciences*. Hillsdale, NJ: Lawrence Erlbaum.
- Dar, R., & Leventhal, H. (1993). Process in pain perception. *Cognitive Therapy and Research*, 17, 341–357.
- Druckman, D., & Bjork, R. A. (1994). *Learning, remembering, believing: Enhancing human performance*. Washington: National Academy Press.
- Elliot, E., & Eccleston, C. (2003). Attentional regulation for adults with chronic pain. In H. Breivik, W. Campbell, & C. Eccleston (Eds.), *Clinical pain management: Practical applications and procedures* (pp. 135–146). London: Arnold.
- Goubert, L., Crombez, G., Eccleston, C., & Devulder, J. (2004). Distraction from chronic pain during a pain-inducing activity is associated with greater post-activity pain. *Pain*, 110, 220–227.
- Gutiérrez, O., Luciano, C., Rodríguez, M., & Fink, B. C. (2004). Comparison between an acceptance-based protocol and a cognitive-control-based protocol for coping with pain. *Behavior Therapy*, 35, 767–783.
- Hadjistavropoulos, H. D., Hadjistavropoulos, T., & Quine, A. (2000). Health anxiety moderates the effects of distraction versus attention to pain. *Behaviour Research and Therapy*, 38, 425–438.
- Harvey, A. G., & McGuire, B. E. (2000). Suppressing and attending to pain-related thoughts in chronic pain patients. *Behaviour Research and Therapy*, 38, 1117–1124.
- Hayes, S., Bisset, R., Korn, Z., Zettle, R. D., Rosenfarb, L. S., Cooper, L. D., et al. (1999). The impact of acceptance versus control rationales on pain tolerance. *Psychological Record*, 49, 33–47.
- Hayes, S., Strosahl, K. D., & Wilson, K. G. (1999). *Acceptance and commitment therapy*. New York: Guilford.
- Hayes, S. C., & Wilson, K. G. (1994). Acceptance and commitment therapy: Altering the verbal support for experiential avoidance. *Behaviour Analyst*, 17, 289–303.
- Hayes, S. C., Wilson, K. G., Gifford, E. V., Follette, V. M., & Strosahl, K. (1996). Experiential avoidance and behavioural disorders: A functional dimensional approach to diagnosis and treatment. *Journal of Consulting and Clinical Psychology*, 64, 1152–1168.
- Heyneman, N. E., Fremouw, W. J., Gano, D., Kirkland, F., & Heiden, L. (1990). Individual differences and the effectiveness of different coping strategies for pain. *Cognitive Therapy and Research*, 14, 63–77.
- Hodes, R. L., Howland, E. W., Lightfoot, N., & Cleland, C. (1990). The effects of distraction on responses to cold pressor pain. *Pain*, 41, 109–114.
- Keogh, E., & Mansoor, L. (2001). Investigating the effects of anxiety sensitivity and coping on the perception of cold pressor pain in healthy women. *European Journal of Pain*, 5, 11–22.
- Korn, Z. (1997). Effects of acceptance/commitment and cognitive behavioral interventions on pain tolerance. *Dissertation Abstracts International*, 58, 2126.
- Koster, E. H., Rassin, E., Crombez, G., & Näring, W. B. (2003). The paradoxical effects of suppressing anxious thoughts during imminent threat. *Behaviour Research and Therapy*, 41, 1113–1120.
- Leventhal, H. (1992). I know distraction works even though it does not. *Health Psychology*, 11, 208–209.
- LoSchiavo, F. M. (1996). The role of practice in thought suppression. Paper presented at the *Sixty-eighth annual meeting of the midwestern psychological association*, May, Chicago, IL.

- Marcks, B. A., & Woods, D. W. (2005). A comparison of thought suppression to an acceptance-based technique in the management of personal intrusive thoughts: A controlled evaluation. *Behaviour Research and Therapy*, 43, 433–445.
- McCaul, K. D., & Malott, J. M. (1984). Distraction and coping with pain. *Psychological Bulletin*, 95, 516–533.
- McCracken, L. M. (1998). Learning to live with pain: Acceptance of pain predicts adjustment in persons with chronic pain. *Pain*, 74, 21–27.
- McCracken, L. M. (1999). Behavioral constituents of chronic pain acceptance: Results from factor analysis of the chronic pain acceptance questionnaire. *Journal of Back and Musculoskeletal Rehabilitation*, 13, 93–100.
- McCracken, L., & Eccleston, Ch. (2003). Coping or acceptance: What to do about chronic pain? *Pain*, 105, 197–204.
- McCracken, L. M., Spertus, I. L., Janneck, A. S., Sinclair, D., & Wetzel, T. (1999). Behavioral dimensions of adjustment in persons with chronic pain: Pain-related anxiety and acceptance. *Pain*, 80, 283–289.
- McCracken, L. M., Vowles, K. E., & Eccleston, Ch. (2004). Acceptance of chronic pain: Analysis and a revised assessment method. *Pain*, 107, 159–166.
- McCracken, L. M., Vowles, K. E., & Eccleston, Ch. (2005). Acceptance-based treatment for persons with complex, long standing chronic pain: A preliminary analysis of treatment outcome in comparison to a waiting phase. *Behaviour Research and Therapy*, 43, 1335–1346.
- Morley, S., Shapiro, D. A., & Biggs, J. (2003). Developing a treatment manual for attention management in chronic pain. *Cognitive Behavior Therapy*, 32, 1–12.
- Purdon, C. (1999). Thought suppression and psychopathology. *Behaviour Research and Therapy*, 37, 1029–1054.
- Purdon, C., & Clark, D. A. (2001). Suppression of obsession-like thoughts in nonclinical individuals: Impact on thought frequency, appraisal and mood state. *Behaviour Research and Therapy*, 39, 1163–1181.
- Purdon, C., Rowa, K., & Antony, M. M. (2005). Thought suppression and its effects on thought frequency, appraisal and mood state in individuals with obsessive-compulsive disorder. *Behaviour Research and Therapy*, 43, 93–108.
- Risdon, A., Eccleston, Ch., Crombez, G., & McCracken, L. (2003). How can we learn to live with pain? A Q-methodological analysis of the diverse understandings of acceptance of chronic pain. *Social Science and Medicine*, 56, 375–386.
- Roelofs, J., Peters, M. L., Van der Zijden, M., & Vlaeyen, J. S. (2004). Does fear of pain moderate the effects of sensory focusing and distraction on cold pressor pain in pain-free individuals? *Journal of Pain*, 5, 250–256.
- Salkovskis, P. M., & Campbell, P. (1994). Thought suppression induces intrusion in naturally occurring negative intrusive thoughts. *Behaviour Research and Therapy*, 32, 1–8.
- Sullivan, M. J. L., Rouse, D., Bishop, S., & Johnston, S. (1997). Thought suppression, catastrophizing and pain. *Cognitive Therapy and Research*, 21, 555–568.
- Trinder, H., & Salkovskis, P. M. (1994). Personally relevant intrusions outside the laboratory: Long-term suppression increases intrusion. *Behaviour Research and Therapy*, 32, 833–842.
- Turk, D. C. (1990). Customizing treatment for chronic pain patients: Who, what and why? *Clinical Journal of Pain*, 6, 255–270.
- Turk, D. C., Meichenbaum, D., & Genest, M. (1983). *Pain and behavioral medicine: A cognitive-behavioral perspective*. New York: Guilford Press.
- Viane, I., Crombez, G., Eccleston, C., Poppe, C., Devulder, J., Van Houdenhove, B., et al. (2003). Acceptance of pain is an independent predictor of mental well-being in patients with chronic pain: Empirical evidence and reappraisal. *Pain*, 106, 65–72.
- Vlaeyen, J. W. S., & Morley, S. (2005). Cognitive-behavioral treatments for chronic pain: What works for whom? *Clinical Journal of Pain*, 21, 1–8.
- Wegner, D. M. (1992). You cannot always think what you want: Problems in the suppression of unwanted thoughts. In M. Zanna (Ed.), *Advances in experimental social psychology* (pp. 193–225). San Diego: Academic Press.
- Wegner, D. M. (1994). Ironic processes of mental control. *Psychological Review*, 101, 34–52.
- Wegner, D., Schneider, D. J., Carter, S., & White, L. (1987). Paradoxical effects of thought suppression. *Journal of Personality and Social Psychology*, 58, 409–418.
- Wegner, D. M., & Wenzlaff, R. M. (1996). Mental control. In E. T. Higgins, & A. W. Kruglanski (Eds.), *Social psychology: Handbook of basic principles* (pp. 2–48). New York: Guilford.
- Wolpe, J., & Lazarus, A. A. (1966). *Behavioural therapy techniques: A guide for the treatment of neuroses*. Oxford: Pergamon Press.