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A comparison of the effect of attention training and relaxation on responses to pain

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ABSTRACT

This study aimed to investigate the efficacy of an attention training technique (ATT) on pain ratings, threshold and tolerance during the cold pressor task. One hundred and three undergraduate students were randomly assigned to receive either threat-alleviating or threat-inducing information about the task. Participants were then re-randomized to receive either ATT or progressive muscle relaxation (PMR). Hence, the present study had a 2 (threat expectancy: high vs. low) × 2 (training: ATT vs. PMR) design. Analyses confirmed that the threat manipulation was effective in increasing the harm associated with the task. ATT resulted in a relative reduction in hypervigilance to sensory pain words compared to PMR. ATT was also associated with a lower degree of focus on internal sensations, but not mindfulness or difficulty disengaging from pain words. Results showed that, relative to relaxation training, those receiving ATT reported pain less quickly than those receiving relaxation, although there were no differences between the training groups for tolerance or pain ratings. These results show that ATT changes the cognitive processes of internal/external focus and hypervigilance towards sensory pain words, but not difficulty disengaging or mindfulness. Although ATT changed threshold, the fact that neither pain ratings nor tolerance was affected suggests that a single, brief session of ATT may not be sufficient to affect broader change. Nonetheless, this study shows that ATT can change cognitive processes thought to be associated with heightened perception of pain and that this changes how quickly pain is registered and is therefore worthy of further investigation.

1. Introduction

Attention to painful stimuli has been highlighted as a determinant of response to pain [6]. If pain is interpreted as threatening, attention is directed to the pain rather than competing tasks. This prompts escape or avoidance behaviours to restore equilibrium [6]. There is considerable research that confirms that pain is associated with high attentional demands that are compounded when the threat value of pain is increased [25].

If attention to pain prompts avoidance, one might expect that interventions that reduce attention to pain would reduce pain and pain-related avoidance. Distraction, for example, has been used as a part of cognitive–behavioural therapy for patients with chronic pain [22]. However, research investigating distraction alone remains inconclusive [12]. It has been suggested that the efficacy of distraction may depend upon the threat value of pain [25]. Van Damme and colleagues manipulated threat and found that distraction increased catastrophic cognitions and anxiety under conditions of high threat. They concluded that caution is required in using distraction when pain is highly threatening, as in clinical settings.

Similar concerns have been discussed in the anxiety literature, with the result that distraction is now viewed as a form of safety behaviour [24]. As such, it is no longer seen as a useful adjunct to therapy with anxious patients. Instead other ways of changing attentional processes have been developed. Wells [28] has developed a method of attention training (ATT) that focuses on helping participants to effortfully re-direct their attention away from threatening internal stimuli, such as catastrophic cognitions thought to fuel anxiety. There is some preliminary evidence that this method is beneficial in patients with panic disorders, social anxiety and hypochondriasis [23,29]. Wells argues that by shifting the focus of attention from internal threatening processes to external factors, anxiety is reduced [23,28,29]. Since pain, like anxiety, is a noxious and potentially threatening internal experience, the rationale for the efficacy of ATT can be expanded to pain. However, ATT has not been trialed in the pain literature.

The aim of this study is to test the efficacy of ATT compared to a control intervention (i.e. relaxation training) using an acute

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experimental pain task. We also aim to determine the likely mechanism of change. Participants were randomized to high or low threat conditions and re-randomized to receive ATT or relaxation before completing the cold pressor task. We hypothesized that the ATT group would have higher threshold and tolerance times and lower pain levels than the relaxation group. Measures were taken of possible cognitive processes that may be changed by ATT, including hypervigilance, difficulty disengaging from pain words, mindfulness and internal/external focus to identify which cognitive processes were shifted as a result of ATT.

2. Method

2.1. Participants

One hundred and four (38 males, 66 females) students from first year psychology at the University of Sydney participated in the study for course credit. Exclusion criteria included a chronic pain condition or a condition that could be affected by induced pain or anxiety; any other current medical or psychological condition; recent use of analgesics; current significant pain, rated as greater than 4/10 on a visual analogue scale; excessive caffeine or alcohol intake in the preceding 24 h (in accordance with NDARC and NHMRC guidelines, respectively); and inability to read or comprehend English. One participant was excluded from the study as they rated their current pain as 5/10 on a visual analogue scale and had consumed six standard units of alcohol in the preceding 24 h. No other participants were excluded. After excluding this participant, the final sample contained 103 (38 males, 65 females) students, aged between 17 and 56 years (mean = 19.48, SD = 4.20).

Participants were randomly assigned to one of the four experimental conditions (attention training/threat; attention training/no threat; progressive muscle relaxation/threat; progressive muscle relaxation/no threat) using the Research Randomizer program (www.randomizer.org). This study was approved by The University of Sydney Human Research Ethics Committee.

2.2. Measures

2.2.1. Fear of pain questionnaire (FPQ) III [19]

The FPQ is a 30-item, self-report measure with three sub-scales (severe, minor and medical pain). It assesses the degree to which both pain and non-pain populations are fearful of pain. Internal consistency is excellent ($\alpha = 0.92$) and test–retest reliability is good ($r = 0.74$) [19]. In the present study, internal consistency was high for the total scale ($\alpha = 0.91$) and for the severe ($\alpha = 0.85$), minor ($\alpha = 0.83$) and medical sub-scales ($\alpha = 0.88$).

2.2.2. Depression, anxiety and stress scales (DASS) [14]

The DASS is a 42-item self-report questionnaire with three subscales that assess depression, anxiety and stress. Internal consistency is high ($\alpha = 0.97$) [4], convergent and discriminant validity are good, and psychometric properties are similar in clinical and non-clinical populations [3,4]. In the present study, internal consistency was high for the total scale ($\alpha = 0.95$) and for the depression ($\alpha = 0.91$), anxiety ($\alpha = 0.84$) and stress ($\alpha = 0.90$) sub-scales. [3,4].

2.2.3. Threat manipulation check

The manipulation check consisted of four questions that assessed the extent to which the cold pressor task information had induced threat or reassured the participant. The questions assessed worry, perceived harm, predicted pain level and coping ability associated with the task, with participants rating their answer on an 11-point numeric scale (0–10).

2.2.4. Toronto mindfulness scale [11]

The Toronto mindfulness scale is a 13-item self-report measure with two sub-scales (curiosity and decentering) that assesses the construct of mindfulness (being aware of the present moment without judging or evaluating any thoughts that may arise) immediately after a meditation session. Internal consistency ($\alpha = 0.93$, $\alpha = 0.91$ for the curiosity and decentering sub-scales, respectively), criterion validity and discriminant validity are good [11]. For the present study, internal consistency was good for the total scale ($\alpha = 0.88$) and the curiosity ($\alpha = 0.91$) and decentering sub-scales ($\alpha = 0.72$).

2.2.5. Self-attention manipulation check [30]

The self-attention manipulation check is routinely employed following ATT and was used in the present study to assess participants' self-focus after engaging in ATT and PMR [30]. It consists of a single item asking participants to rate the intensity of their self-focus on a 7-point numerical Likert scale. The Likert scale ranges from −3 (indicating they are entirely externally focused) and +3 (indicating they are entirely self-focused).

2.2.6. Pain measures

Four pain measures were taken during the experiment. Threshold and tolerance times were recorded by the experimenter. Threshold refers to time (in seconds) at which the participants first registered pain after placing their arm in the cold pressor. Tolerance refers to the time (in seconds) at which the participants withdrew their arm from the cold pressor. The experimenter also recorded participant pain ratings during the course of the task; that is, pain at threshold, pain 30 s after threshold and level of pain at tolerance. For these ratings, participants were asked to rate their pain on an 11-point numeric scale ranging from 0 (no pain) to 10 (extremely intense pain).

2.3. Materials

2.3.1. Dot-probe task [5,15]

Attentional bias was assessed using a modified version of the dot-probe task, used extensively in previous pain research [5]. Subjects were presented with a fixation point '.' that appeared in the centre of the computer screen for 500 ms. Following this, a pair of words was presented on screen for 500 ms, with one word presented above the fixation point and one word presented below the fixation point. The pair of words then disappeared from screen and one of these words was subsequently replaced by a probe (either the letter 'p' or the letter 'q'). Each participant was instructed to press either the letter 'p' or the letter 'q' on the keyboard, according to which had appeared on screen. A new pair of words was presented after a response was made or after 1500 ms had elapsed without a response. Participants completed five practice trials with feedback from the experimenter, prior to completing the experimental trials to ensure that participants completely understood task requirements. Participants completed 200 experimental trials, which were presented in five blocks of 40 trials, with a 1-min break between blocks. As such, the dot-probe task was approximately 12 min in duration.

2.3.2. Word stimuli

The stimulus set for the dot-probe task was comprised of words from four pain-related threat categories (sensory, affective, disability and general) and neutral words. Each pain-related word pair contained a target word from one of the four pain categories and a matched neutral word, whilst word pairs in the neutral category contained two neutral words (i.e. neutral–neutral trials). Within each of the word categories (sensory, affective, disability, general and neutral) there were 10 word pairs, matched in frequency and length. The pain-related word pairs were taken from previous