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

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A B S T R A C T
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 clinical conditions. 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.

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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 effortlessly 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
experimental pain task. We also aim to determine the likely mecha-

nism 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 con-
dition; 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 experi-
mental 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 (z = 0.92) and test–retest reliability is good
(r = 0.74) [19]. In the present study, internal consistency was high
for the total scale (z = 0.91) and for the severe (z = 0.85), minor
(z = 0.83) and medical sub-scales (z = 0.88).

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

The DASS is a 42-item self-report questionnaire with three sub-
scales that assess depression, anxiety and stress. Internal consist-
ency is high (z = 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 consist-
ency was high for the total scale (z = 0.95) and for the depression
(z = 0.91), anxiety (z = 0.84) and stress (z = 0.90) sub-scales. [3, 4].

2.2.3. Threat manipulation check

The manipulation check consisted of four questions that as-
sessed 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 with-
out judging or evaluating any thoughts that may arise) immediately
after a meditation session. Internal consistency (z = 0.93, z = 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 (z = 0.88)
and the curiosity (z = 0.91) and decentering sub-scales (z = 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 partic-
ipants’ 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 with-
drew 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]. Sub-
jects 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 pre-
sewed above the fixation point and one word presented below the
fixation point. The pair of 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 pre-
sewed 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 experi-
mental 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, disabil-
ity 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
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