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ATTENTION FOCUS, TRAIT ANXIETY, AND PAIN PERCEPTION IN PATIENTS UNDERGOING COLPOSCOPY

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ABSTRACT

Few studies have compared the relative efficacy of attention-focus strategies in reducing clinical pain. Colposcopy, a medical diagnostic examination performed to identify premalignant cervical cell changes, elicits both anxiety and pain in patients, while allowing little or no behavioural control over the event. Employing a multi-group experimental design, the present study sought to investigate how different types of attention-focus strategies impacted upon pain perception, state anxiety, and affect, in a sample of 123 colposcopy patients. Patients were randomly assigned to one of three groups: sensory focusing, active distraction, and undirected control. Psychometric measures of pre-colposcopy pain expectancy and dispositional trait anxiety were also taken, in order to assess whether these factors further contributed to outcomes. Overall, when controlling for pain expectancy and trait anxiety, self-reported pain intensity, sensory pain, and affective pain did not differ across groups. Further, there were no significant between-groups differences in colposcopy-related state anxiety or affect. However, pre-colposcopy psychometric measures were found to be predictive of a range of outcomes. Pre-colposcopy pain expectancy, but not trait anxiety, was found to be positively related to colposcopy-related pain. It was further demonstrated that heightened state anxiety following colposcopy was due to experienced pain and pain unpleasantness, rather than to aspects of the pre-colposcopy prediction of pain. The results have implications for management of acute clinical pain.

Key words: trait anxiety, attention, pain, medical procedure

1. Introduction

Strategies based on directing people to focus their attention in particular ways, such as distraction (i.e., focusing attention away from noxious sensations) and sensory focusing (i.e., the non-emotional processing of a noxious stimulus), have been shown to greatly assist the reduction of pain perception (Ahles et al., 1983; Dar and Leventhal, 1993; Keogh and Herdenfeldt, 2002; Leventhal et al., 1979). Limited-capacity models of attention predict that pain perception will be reduced due to attentional competition between task- and pain-processing (McCaul & Malott, 1984). Recent extensions of the limited-capacity models of attention explain how orienting attention to painful stimuli depends on both top-down and bottom-up selection of sensory inputs (Legrain et al., 2009). Top-down selection refers to goal-directed and intentional processing which prioritises information relevant for current action. Bottom-down selection refers to involuntary orientation of attention where attention is captured by events themselves (such as nociceptive signals), which can be modulated by top-down processes. This neurocognitive model of attention explains how a painful stimulus can capture attention even when an individual is deliberately focusing attention to other events. It can also explain how attentional capture by painful stimuli can be controlled by top-down processes (Van Damme et al., 2010). Sensory focusing is suggested to capitalise on parallel processing of sensory and affective components of the painful stimulus (Leventhal and Everhart, 1980) and depending on whether attention is focused on the sensory or emotional aspects of the stimulus, pain perception is either reduced or increased. Non-emotional attention to the sensory features of a noxious stimulus reduces pain perception by modifying the pain schema, whereas attending to the emotional features of a noxious stimulus increases pain perception by increasing the salience of the affective pain schema (Keogh and Herdenfeldt, 2002).

Much of the research examining the impact of attention focus on pain perception has been conducted in laboratory settings, using healthy participants exposed to relatively innocuous levels of experimentally-induced pain. While laboratory studies offer a certain degree of control over extraneous variables, the fact that participants can terminate the painful stimulus at any time undermines external validity. As such, there is as yet limited basis to generalise findings regarding cognitive coping strategies to patients experiencing medically relevant pain (Baron et al., 1993; Chan et al., 2003; Haythornthwaite et al., 2001; Logan et al., 1995).

Furthermore, experimental and field studies have demonstrated that pain expectancy is correlated with experience of pain, such that individuals who anticipate more pain subsequently report greater pain intensity (Bachiocco et al., 1993; Campbell et al., 1999; Sullivan et al., 2001). It is likely that the role of pain expectancy is particularly important in the case of medical procedures, where the implications of pain may be perceived as threatening (Gedney and Logan, 2007). Pain expectancies may further influence emotional distress responses to painful stimulation, particularly anxiety and fear reactions (Sullivan et al., 2001; Wallace, 1985).

With respect to anxiety, it may affect the experience of pain by influencing the sensory process, enhancing sensitivity to pain (Litt, 1996; Melzack and Wall, 1965; Robinson and Riley III, 1999). Heightened levels of state anxiety have been found to increase subjective pain reports (Cornwall and Donderi, 1988; Tang and Gibson, 2005) and reduce pain thresholds and tolerance (Carter et al., 2002; Rhudy and Meagher, 2000) although contrary findings have been reported (Jones et al., 2002). Heightened levels of trait anxiety have been found to reduce pain tolerance (James and Hardardottir, 2002) and increase subjective pain reports, regardless of state anxiety levels (Tang and Gibson, 2005).

The present study sought to investigate the independent and combined effects of attention focus strategies and psychometrically assessed person variables on pain perception in a sample of patients undergoing colposcopy for the first time. Colposcopy is an invasive diagnostic procedure, of relatively short duration (approximately 10 minutes), aimed at detecting pre-cancerous cervical lesions using a flexible magnifying viewing instrument (colposcope) to examine the woman's cervix. It is highly anxiety-provoking (Freeman-Wang et al., 2001; Rogstad, 2002; Walsh et al., 2004) and involves moderate pain (Chan et al., 2003; Kola and Walsh, 2009). Further, similar to many medical procedures, colposcopy patients have little control over the procedure, and must undergo it without direct social support. Therefore, such patients may be particularly responsive to manipulations of attention.

2. Methods

2.1. Participants

One hundred and twenty-three women from a colposcopy clinic attached to a University medical school attending for colposcopy due to abnormal cervical smear test results were consecutively recruited. Women were eligible for inclusion in the study if they were first-time colposcopy patients referred with an abnormal cervical smear result. Exclusion criteria were: age less than 18 years, history of severe cardiac, pulmonary, or liver disease, epilepsy or chronic pain, to minimise differences in health status. This information was obtained by a self-report checklist.

Mean age of patients was 30.37 years (SD = 8.91), which represents the age of peak incidence of cervical pre-cancerous lesions (Parkin et al., 2001). All women were of white Irish origin, the majority were single (58%), the remainder were either married or living as married (40%), or separated/divorced (2%). Fifty-eight percent reported having completed

higher education. All procedures were reviewed and approved by the local institutional research ethics review committee.

2.2. Design

All patients were randomly assigned to one of three attentional strategy groups (sensory focus, active distraction, and undirected control; $n = 41$ per group), which provided the basis for between-group comparisons. The predictive validity of pre-colposcopy measures was tested by including these measures as covariates in statistical analyses. The dependent variables consisted of various self-report measures of pain experience (intensity, pain unpleasantness, sensory and affective measures), state anxiety and affect.

2.3. Attention strategies

2.3.1. Sensory Focus (FOCUS) group

In the FOCUS group, patients were required to focus on the sensory experience of the colposcopy examination, paying close attention to the many different sensations they would experience during the examination. The importance of non-emotional labelling of the experienced sensations was stressed with this sample. To enhance the focus on the sensory experience, patients were required to view their examinations on a video-colposcopy monitor in real-time (Leventhal et al., 1989; Shiloh et al., 1998). Finally, to increase adherence to this procedure, patients were told that following the colposcopy, they would be asked questions about the various sensations experienced.

2.3.2. Active distraction (DISTR) group

Patients in the DISTR group engaged in a lexical decision task during the colposcopy examination. The task was presented on a laptop computer, and the patients were required to decide whether five-letter strings presented individually on the screen were words or non-words, by pressing one of two buttons on a two-button response box. The task contained 180 trials and words and non-words were randomly presented. The patients were in charge of viewing time of words, with individual strings presented until a response had been made, and instructions stressed the importance of speed and accuracy. The words were neutral (e.g., apple, spade) and non-words were pronounceable, therefore resembling proper words (e.g., yudge, velve). This task was chosen as it was affectively neutral (Eccleston and Crombez, 1999), cognitively engaging (McCaul and Malott, 1984) and requiring a moderate amount of mental processing (McCaul et al., 1992). All patients were observed to engage in the active distraction task, and this was confirmed by performance data. The mean reaction time was 4.13s (*SD* = 2.03) and the mean correct response was 92.08% (*SD* = 6.05).

2.3.3. Undirected Control (CTRL) group

In the CTRL group, no explicit attempt was made to focus patients' attention, and these patients underwent the procedure according to standard care.

2.4. Measures

2.4.1. State-Trait Anxiety Inventory (STAI)

The STAI (Spielberger et al., 1983) was used to determine the patients' state and trait anxiety levels. The State Anxiety Inventory consists of 20 statements and assesses the frequency of respondents' feelings at the present moment on a four-point scale ranging from 'not at all' to 'very much so'. The Trait Anxiety Inventory also consists of 20 statements and assesses the frequency of respondents' feelings in general on a four-point scale ranging from

'almost never' to 'almost always'. The possible range of scores for each scale is between 20-80, with a higher score indicating greater anxiety. Reliability and validity of this scale has been established (Spielberger et al., 1983). In the present study, Cronbach's alpha was .93 for the state scale, and .90 for the trait scale.

2.4.2. Expectations of pain intensity and pain unpleasantness

Prior to the initial pre-colposcopy medical examination, patients were asked to complete two 100-mm visual analogue scales (VAS) assessing their expectations of pain intensity and pain unpleasantness during the colposcopy. The pain intensity VAS was anchored by 'no pain' and by 'pain as bad as it could be' at either end. The pain unpleasantness VAS was anchored by 'no discomfort' and 'worst discomfort' at either end. VASs are scored by measuring the distance (in mm) from the 'no pain' anchor to the respondent's mark, with a higher score indicating a greater expectation of pain intensity or unpleasantness. VASs with extreme anchors and of sufficient length ($\geq$ 10cm) have been shown to have the greatest sensitivity and are the least vulnerable to distortions (Price et al., 2001). Test-retest reliability of VASs measuring pain intensity and pain-related affect are high (r = .90, and r = .70-.90, respectively; Price et al., 2001) and VASs have also been shown to correlate highly with other pain rating scales (Jensen and Karoly, 2001; Jensen et al., 1986).

2.4.3. Experienced pain intensity and pain unpleasantness

Two 100-mm VASs were used post-procedurally to measure the intensity of pain and pain unpleasantness experienced during the colposcopy examination. The same anchors were used as for the expectation VASs.

2.4.4. McGill Pain Questionnaire (MPQ)

This measure assessed the different components of reported pain during the colposcopy, namely the sensory, affective and evaluative components of the pain experience. The sensory component of pain relates to its temporal, spatial, pressure and thermal properties. The affective component of pain relates to its tension, fear, and autonomic properties, while the evaluative component relates to its subjective overall intensity.

The MPQ (Melzack, 1975) requires the respondent to choose the words that best describes their sensations from a list of 78 adjectives, which can be split into four categories of pain descriptors: sensory, affective, evaluative and miscellaneous. The MPQ was also used to assess peak pain during the examination, using one of the following numbers: (1) mild, (2) discomforting, (3) distressing, (4) horrible, and (5) excruciating. Reliability and validity have been established (Melzack and Katz, 2001).

2.4.5. The Positive and Negative Affect Schedule (PANAS)

The PANAS (Watson et al., 1988) was administered to assess mood before and after the colposcopy examination. This measure assesses state dimensions of positive and negative affectivity, by asking patients to rate "the extent to which they feel this way right now, that is, at the present moment". The scale consists of 20 adjectives used to describe different feelings and emotions. Ten adjectives describe negative moods (e.g., distressed, upset), and ten adjectives describe positive moods (e.g., interested, excited). Responses are made on a five-point scale, from 'very slightly, or not at all' to 'extremely'. Positive affect (PA) is measured by adding the ten positive mood adjectives and negative affect (NA) is measured by adding the ten negative mood adjectives. Scores range from 10 to 50 on both scales, with a higher score indicating greater positive or negative affectivity.

Reliability and validity has been established (Crawford and Henry, 2004; Watson et al., 1988). In the present study, Cronbach's alpha was .82 for the PA scale, and .82 for the NA scale.

2.4.6. Coping Behaviours Inventory

This 24-item coping scale was based on the Coping Strategies Questionnaire (Rosenstiel and Keefe, 1983), and measured four types of coping behaviours: diverting attention, reinterpreting sensations, ignoring sensations, and coping self-statements, and has been used previously (James and Hardardottir, 2002). It was administered to examine the spontaneous coping strategies employed by the patients in the undirected control condition. Cronbach's alpha for diverting attention was .83, for reinterpretation .64, for ignoring .56, and for coping self-statements it was .65.

2.5. Procedure

Clinic procedure required all presenting patients to be initially interviewed by a nurse before waiting in a designated waiting room. First-time patients were then individually invited into a quiet office adjacent to the colposcopy room. At this point, patients were invited to take part in the study and given full information about the purpose and procedures of the research. Patients were also informed of the specific experimental group to which they had been randomly assigned, after which, if the patient volunteered to participate, informed consent was obtained.

Patients in the FOCUS group were instructed to pay close attention to the different sensations they would experience during the examination, as they would be required to answer questions about these sensations following the colposcopy examination. Patients in the

FOCUS group also watched their procedure on a video screen. Patients in the DISTR group were told that they would have the opportunity to play a computer game during the examination, which would require them to make a decision if a word presented was a word or a non-word. Finally, patients in the CTRL group were told that they would be required to answer questions before and after the colposcopy examination. Although the researcher was not blind to the allocation of participants to attention strategy groups, great care was taken to ensure standardisation of instructions throughout.

The pre-colposcopy questionnaires included background information, expectations of pain intensity and pain unpleasantness, the STAI, and the PANAS. On completion of the questionnaires, the patient was requested to sit in the waiting room until called by the nurse colposcopist.

Patients engaged in their assigned attention strategies during colposcopy, and the final questionnaires were completed immediately following the examination. These included pain intensity and pain unpleasantness experienced during the examination, the McGill Pain Questionnaire, the State Anxiety Inventory, the PANAS, and the Coping Behaviours Inventory.

2.6. Statistical analysis

Categorical demographic information was analysed using chi-square analyses, and continuous baseline data were analysed using one-way analyses of variance (ANOVA). A series of one-way analyses of covariance (ANCOVAs), with attention strategy (FOCUS, DISTR, and CTRL) as the between-groups factor and trait anxiety and expectation of pain as covariates, were conducted to investigate the effect of attentional strategy on pain experience while testing for trait anxiety and pain expectancy. Given that different aspects of the pain experience were investigated (i.e., intensity, sensory, affective and evaluative) rather than the

combination of pain variables, separate ANCOVA analyses were chosen rather than multivariate ANCOVAs (Forys and Dahlquist, 2007; James and Hardardottir, 2002). Two of the MPQ items, evaluative and miscellaneous pain were log transformed in order to reduce the effects of non-normality (Field, 2005).

Affect and state anxiety variables were analysed using 3 × 2 mixed ANCOVAs, with attention strategy as the between-groups factor (FOCUS, DISTR, and CTRL), trait anxiety as the covariate, and with 'time' (pre- and post-colposcopy) as a repeated-measures factor for each of the mood and state anxiety variables. The data from the coping behaviours inventory were analysed using one-way ANCOVAs, with trait anxiety as the covariate.

3. Results

Chi-square analyses revealed that the attention strategy groups were comparable in marital status, education level, smoking status, dyskariosis severity and time of day of appointment *p*s >.05. One-way ANOVAs found no group differences in waiting time for appointment, expectations of pain intensity and unpleasantness, trait anxiety scores and there were no group baseline differences in state anxiety or mood, *p*s >.05.

3.1. Visual analogue scales

The mean values of pain intensity and pain unpleasantness are presented in Table 1. A one-way ANCOVA with trait anxiety and expectations of pain intensity as the covariates revealed that expectations of pain was significantly related to experienced pain intensity, $F(1, 116) = 9.98$, $p = .002$, partial $\eta^2 = .079$, with greater expectations associated with higher pain intensity reports ($r = .29$). Trait anxiety was not significantly related to experienced pain intensity, $F(1, 116) = .14$, $p = .71$, and the trait anxiety × attention strategy interaction was non-significant, $F(2, 116) = .89$, $p = .42$. There was no main effect for attention strategy on

experienced pain intensity after controlling for pain expectancy and trait anxiety, $F(2, 116) = .67$, $p = .51$.

A one-way ANCOVA with trait anxiety and expectations of pain unpleasantness as the covariates revealed that expectations of pain unpleasantness was significantly related to experienced pain unpleasantness, $F(1, 116) = 7.80$, $p = .006$, partial $\eta^2 = .063$, with greater expectations associated with higher pain unpleasantness ratings ($r = .26$). Trait anxiety was not significantly related to experienced pain unpleasantness, $F(1, 116) = .64$, $p = .42$, and the interaction between trait anxiety and attention strategy was also non-significant, $F(2, 116) = .88$, $p = .42$. There was no significant main effect for attention strategy on experienced pain unpleasantness after controlling for expectancy and trait anxiety, $F(2, 116) = .81$, $p = .45$.

3.2. McGill Pain Questionnaire items

The mean values of all the MPQ items are presented in Table 1. Expectation of pain was significantly associated with sensory pain, $F(1, 116) = 5.18$, $p = .025$, partial $\eta^2 = .043$, with greater expectations associated with higher sensory pain reports ($r = .22$). Trait anxiety was not related to sensory pain, $F(1, 116) = .35$, $p = .55$, and the trait anxiety × attention strategy interaction was also non-significant, $F(2, 116) = 1.06$, $p = .35$. There was no significant effect of attention strategy on sensory pain after controlling for pain expectancy and trait anxiety, $F(2, 116) = .87$, $p = .42$.

Expectation of pain was significantly associated with affective pain, $F(1, 116) = 4.04$, $p = .047$, partial $\eta^2 = .034$, with greater expectations associated with higher affective pain reports ($r = .19$). Trait anxiety was not significantly associated with affective pain $F(1, 116) = .009$, $p = .92$, and the trait anxiety × attention strategy interaction was also non-significant, $F(2, 116) = 1.27$, $p = .29$. There was no significant effect of attention strategy on affective pain after controlling for pain expectancy and trait anxiety, $F(2, 116) = 1.08$, $p = .34$.

Expectation of pain was not significantly associated with evaluative pain, $F(1, 116) = .74$, $p = .39$. Trait anxiety was not significantly associated with evaluative pain, $F(1, 116) = .35$, $p = .56$, and the trait anxiety × attention strategy interaction was also non-significant, $F(2, 116) = 1.49$, $p = .23$. There was no significant effect of attention strategy on affective pain after controlling for pain expectancy and trait anxiety, $F(2, 116) = .79$, $p = .46$.

Trait anxiety was significantly associated with miscellaneous pain, $F(1, 116) = 4.11$, $p = .045$, partial $\eta^2 = .034$, such that higher trait anxiety was associated with greater miscellaneous pain ($r = .16$). Expectation of pain was not associated with miscellaneous pain, $F(1, 116) = .36$, $p = .55$. There was no significant main effect for attention strategy on miscellaneous pain after controlling for pain expectancy and trait anxiety, $F(2, 116) = .78$, $p = .46$. The trait anxiety × attention strategy interaction was also non-significant, $F(2, 116) = 1.85$, $p = .16$.

Expectation of pain was significantly associated with peak pain, $F(1, 116) = 5.58$, $p = .020$, partial $\eta^2 = .042$. There was no main effect for trait anxiety, $F(1, 116) = .05$, $p = .83$. The interaction between trait anxiety and attention strategy was similarly non-significant $F(2, 116) = .99$, $p = .37$. Controlling for expectation of pain and trait anxiety, there was no main effect for attention strategy on peak pain, $F(2, 116) = .92$, $p = .40$.

3.3. Self-reported affect and coping behaviour

The mean values of state anxiety, positive and negative affect are presented in Table 2. There was a main effect of time on state anxiety, $F(1, 117) = 6.32$, $p = .013$, partial $\eta^2 = .051$, with pre-colposcopy state anxiety significantly greater ($M = 44.97$, $SD = 11.81$) than post-colposcopy ($M = 35.17$, $SD = 10.44$). Trait anxiety was significantly related to state anxiety, $F(1, 117) = 16.22$, $p < .001$, partial $\eta^2 = .122$, with greater trait anxiety associated with increased levels of state anxiety ($r = .38$). There was no main effect of attention strategy on

state anxiety after controlling for trait anxiety, nor were there any significant interactions, all *p*s >.05.

Trait anxiety was significantly associated with positive affect, $F(1, 117) = 12.47$, $p < .001$, partial $\eta^2 = .096$, with greater trait anxiety associated with reduced positive affect ($r = -.33$). There was no significant main effect for time or attention strategy on positive affect, nor were there any significant interaction effects, all *p*s >.05.

Trait anxiety was significantly associated with negative affect, $F(1, 117) = 18.16$, $p < .001$, partial $\eta^2 = .134$, with greater trait anxiety associated with increased levels of negative affect ($r = .38$). There was also a significant trait anxiety × attention strategy interaction, $F(2, 117) = 4.43$, $p < .014$, partial $\eta^2 = .070$. In the CTRL group, the correlation between trait anxiety and negative affect was close to zero ($r = .06$), but in the DISTR and FOCUS groups, the correlations were positive ($r = .34$ and $r = .62$, respectively). There was no significant main effect for time or attention strategy on negative affect, all *p*s >.05.

There were no significant differences between the three groups in self-reported use of coping self-statements, reinterpretation, ignoring or diverting attention after controlling for trait anxiety, all *p*s >.05. See Table 1 for mean values.

3.4. Anticipation of pain and experienced emotional distress

Following Sullivan, Rodgers, and Kirsch (2001), error scores were computed by subtracting pain expectancy and pain unpleasantness expectancy ratings from experienced pain ratings (prediction error = experienced pain – pain expectancy). Scores of 0 represent perfect prediction, whereas positive scores represent under-prediction and negative scores represent over-prediction. Pearson's product moment correlations revealed that trait anxiety was not associated with pain prediction errors, all *p*s > .05. Pre-colposcopy state anxiety was associated with over-prediction of pain intensity ($r = -.22$, $p = .013$), but was not associated

with prediction errors of pain unpleasantness. Pre-colposcopy NA was associated with over-prediction of pain intensity (r = -.37, p = .001) and over-prediction of pain unpleasantness (r = -.18, p = .047).

Under-prediction of pain intensity (r = .19, p = .034), and under-prediction of pain unpleasantness (r = .18, p = .049) was associated with greater post-colposcopy state anxiety. However, under-prediction of pain intensity was not associated with greater post-colposcopy state anxiety when controlling for experienced pain intensity (r = .05, ns), and under-prediction of pain unpleasantness was not associated with greater post-colposcopy state anxiety when controlling for experienced pain unpleasantness (r = -.06, ns). The pattern of these results suggest that heightened state anxiety following colposcopy is not due to under-prediction of pain, but rather experienced pain and pain unpleasantness.

4. Discussion

One of the key aims of the present study was to investigate whether different attention strategies (i.e., active distraction, sensory focusing, undirected control) affected pain perception in women undergoing colposcopy. Overall, the data showed no observed differences in self-reported pain perception between the attention strategy groups, when controlling for pain expectancy and trait anxiety. Women undergoing colposcopy in the active distraction and sensory focusing goups reported similar pain intensities and pain affect to women in the undirected control group. These findings are in line with those of other studies examining the use of attention strategies for reducing pain in patients undergoing invasive medical procedures (Danhauer et al., 2007; Haythornthwaite et al., 2001), which have also failed to observe analgesic effects of attention strategies on patients' self-reported pain ratings. The results from the present study are, however, contrary to laboratory studies using

analogue pain, which have found both distraction and sensory focusing to be effective in reducing pain sensation (Ahles et al., 1983; James and Hardardottir, 2002; Keogh and Herdenfeldt, 2002; McCaul and Malott, 1984; Roelofs et al., 2004).

It is possible that differences in methodologies, particularly the pain stimulus and its meaning explain the discrepant findings between clinical and laboratory studies. For example, in laboratory studies pain is frequently induced using electrical pain stimuli (Tang and Gibson, 2005) or the cold pressor task (Ahles et al., 1983; James and Hardardottir, 2002; Roelofs et al., 2004). Pain induced by electrical stimulation bypasses the nociceptors and activates the pain fibres directly, causing a novel throbbing sensation (Handwerker and Kobal, 1993; Kenntner-Mabiala et al., 2007). Pain induced by the cold pressor task, on the other hand, results in a deep, aching pain which rapidly increases to reach its peak within 60 seconds, after which it levels off (Handwerker and Kobal, 1993; Wolf and Hardy, 1941). Thus, such experiences are quite different from clinical situations, where pain may be intermittent, diffused, and poorly localised (Chapman and Turner, 1986).

Furthermore, it is likely that the meaning of the pain contributes to the differences in results between clinical and laboratory studies assessing the use of attention strategies. Specifically, the pain elicited by the colposcopy examination is a due to a clinically relevant stimulus in a clinically relevant setting, which is novel and likely to be perceived as threatening and emotionally charged. In contrast, laboratory studies carry low threat-value, as participants are aware that the risk of tissue damage and actual physical threat are extremely remote (Baron et al., 1993). Therefore, the cognitive and emotional impact of induced laboratory pain might be very different from clinical pain (Horn and Munafo, 1997). It has been demonstrated that pain appraised as threatening tends to be associated with the use of fewer cognitive coping strategies (such as attention diversion, reinterpretation, ignoring, or coping self-statements) when dealing with the noxious experience (Jackson et al., 2009;

Jackson et al., 2005), as well as with less engagement in distraction tasks (Van Damme et al., 2008). It has also been demonstrated that sensory focusing results in reduced pain tolerance when pain is perceived as threatening (Boston and Sharpe, 2005). Similarly, novel painful stimuli have been associated with shifts in attention which may lead to task interference and thus less engagement in distraction tasks (Crombez et al., 1996), although contrary results have been reported (Veldhuijzen et al., 2006). Furthermore, unlike with an invasive medical procedure which is under the control of a physician and where the pain is a necessary byproduct to which the patient has consented, in laboratory protocols participants are at all times personally in control of the termination of the pain-causing stimulus, insofar as ethical principles entitle them to withdraw from the procedure at any time. Perceived control changes the meaning of a noxious event and increases participants' ability to endure and tolerate pain (Feldner and Hekmat, 2001; Litt, 1988). Therefore, it is possible that applying attention strategies to control acute pain has limited utility in clinical contexts. However, it is also possible that patients' own spontaneous coping strategies are more efficacious than their assigned strategies. In the present study, although no differences were found between the three groups on any of the self-reported coping behaviours, the parameters of the study only allow us to conclude that the attention strategies appear to be no better than the spontaneous coping strategies patients engage in.

In the present study we attempted to control for two variables that may help elucidate these issues. The first related to the observation that pain expectancy influence self-reported pain, and thus should be taken into account when assessing pain reports. In this study, pain expectancy was found to be associated with experienced pain, such that greater pain expectancy prior to colposcopy resulted in higher self-reported pain ratings. This finding may suggest an important avenue for future research interested in reducing pain associated with colposcopy. Rather than targeting interventions intra-procedurally, reducing pain expectancies

prior to invasive medical procedures may lead to lower intra-procedural pain. Furthermore, under-prediction of pain and pain unpleasantness was associated with greater post-colposcopy state anxiety, as reported in other studies (Wallace, 1985). However, these correlations were no longer significant when taking into account experienced pain and pain unpleasantness, suggesting that it is the actual experience of pain during colposcopy, rather than inaccurate pain expectancies, that contribute to post-colposcopy state anxiety. These findings are in line with those of previous research using healthy participants subjected to a cold pressor task (Sullivan et al., 2001).

The second issue relates to propositions that trait anxiety may influence the experience of pain. A number of studies have provided support for this suggestion (James and Hardardottir, 2002; Tang and Gibson, 2005). In the present study, trait anxiety influenced only the MPQ item 'miscellaneous pain', with greater trait anxiety associated with greater miscellaneous pain. It is not clear why there was no general effect of trait anxiety on the measures of pain intensity and pain affect, as previous studies have found that high trait anxious individuals report greater pain intensities than low trait anxious individuals (James and Hardardottir, 2002; Tang and Gibson, 2005).

The finding that attentional strategy did not systematically affect self-reported state anxiety, positive affect, or negative affect associated with the colposcopy examination is consistent with previous research (James and Hardardottir, 2002). Trait anxiety was significantly associated with state anxiety and negative affect, while there was a significant inverse relationship between trait anxiety and positive affect. Similarly, the MPQ measures of sensory, affective, and evaluative pain were not associated with significant main or interaction effects.

The results of the present study may broadly suggest that attention strategies have limited utility in clinical situations. Distraction and sensory focusing did not result in lower

pain perception compared with an undirected control group. However, before reaching such a conclusion, the limitations of the study must be acknowledged. Distraction was manipulated by the use of a lexical decision task, as it has been demonstrated that distraction with an external focus are the most effective in affecting pain perception (Johnson et al., 1998). The use of the computer task may have appeared contrived or the task may not have been sufficiently engaging, which may have affected absorption, which may in turn have reduced the efficacy of distraction. It is also possible that the novelty of the colposcopy pain may have interrupted engagement in the distraction task, driven by bottom-up selection processes (Van Damme et al., 2010), and thereby reduced the efficacy of distraction. Although all women were observed to engage in the task, with performance data confirming it, further research examining previous experience of clinical pain may help elucidating the effect of novelty on pain perception. The duration of the colposcopy examination may have been too long, and thus rendered distraction ineffective, as it has been suggested that distraction is suitable for short periods of time, but that it loses its potency after prolonged noxious stimulation (McCaul and Malott, 1984; Suls and Fletcher, 1985).

With regards to sensory focusing, the women received standard instructions, but were only exposed to the intervention approximately 40 minutes before they were asked to apply it, and thus had little opportunity to practice the method, which may have reduced its benefit. It has been suggested that the successful use of sensory focus for clinical pain management may require training and feedback (Haythornthwaite et al., 2001). However, that assertion remains to be confirmed by research, as laboratory studies that have found beneficial effects of sensory focusing have not included training sessions. Finally, it should be noted that there is potentially unsystematic variability in what constitutes standard care that may have influenced the results in unplanned and unknown ways (Fauerbach et al., 2002). For example, some colposcopists talk frequently and enthusiastically, which may be perceived by the patient as

providing distraction or social support. However, some of this interaction can be pleasant and other aspects less so to the patient (Lang et al., 2005).

Indeed, the clinical setting itself may increase variability across all groups, by introducing errors such as variations in patient management and the timing and duration of the examination. We attempted to minimise this variability by assessing patients under identical circumstances. Thus, one nurse colposcopist, who was instructed to not vary her routine or interactions with patients, carried out all the colposcopy examinations in the same clinic, and the same researcher assessed all women.

In addition, when measuring subjective reactions to pain, a choice has to be made between obtaining pain ratings during noxious stimulation or following the termination of it. We decided against the use of intra-procedural pain ratings due to the incompatibility of giving pain ratings while attempting to divert attention from pain. This decision is unlikely to have adversely affected the obtained results, as it has been demonstrated that retrospective pain ratings are not significantly different from ratings of pain given in real time (Koyama et al., 2004; Terry et al., 2007).

Finally, some authors recommend using statistical adjustments, such as Bonferroni, when conducting multiple univariate statistical tests, where such adjustments serve to modify the overall alpha level to reduce the chance of Type I errors. However, we decided against an adjustment of alpha level, for example by introducing a Bonferroni correction, because of the associated problems with such corrections (Nakagawa, 2004; Perneger, 1998). In particular, although Bonferroni corrections reduce the risk of making Type I errors by reducing the alpha value applied to each null hypothesis, so that the study-wide error rate remains at $p < .05$, this inflates the risk of Type II errors, so that clinically relevant differences may be unrecognized. Also, as noted by Perneger (1998), the study-wide error rate applies to the universal null hypothesis, which is often irrelevant to the researchers. Therefore, in a study such as this one

it is important to assess each measure in its own right, and we further consider that reporting our findings is important in generating hypotheses that can be tested in future studies. Nevertheless, we acknowledge that some findings would not be considered statistically significant with the application of Bonferroni corrections, thus, the findings need to be replicated in future studies.

The strengths of the present study included the use of first time patients, controlling for prior experience of the colposcopy examination. Colposcopy thus presented a novel stressor for all women in the study. In addition, the selected medical procedure is a standardised examination which is known to be stressful and painful, and of sufficient duration to investigate the use of cognitive coping strategies. The different aspects of pain were measured following the examination, in order to avoid disrupting attempts of attention diversion.

In summary, the present study failed to demonstrate an effect of attention-based interventions on pain perception. Expectations of pain, however, were associated with the pain reports of patients. Furthermore, trait anxiety did not have an effect on pain perception, apart from miscellaneous pain. These data suggest that for women undergoing colposcopy, trait anxiety is not an important mediator of pain responses. Although these results are in line with previous research in clinical settings (Danhauer et al., 2007; Haythornthwaite et al., 2001), experimental evidence support the use of attention strategies in reducing pain perception (e.g., James and Hardardottir, 2002; Keogh and Herdenfeldt, 2002). Future research examining these strategies in clinical settings may develop more natural and cognitively engaging tasks, for example by utilising virtual reality technology, or designing tasks that demonstrate standardised flexibility, ensuring each participant is equally challenged throughout the task. It would also be of interest to manipulate instructions to include

expectations of efficacy, which may in turn affect participants' motivation to engage in the assigned strategies.

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TABLE 1. Mean (*SD*) pain and coping behaviours in each of three attention strategy groups (*n* = 123)

Variable	DISTRACTION	FOCUS	CONTROL
Pain expectancy	37.79 (31.11)	33.83 (23.36)	38.98 (23.50)
Pain unpleasantness expectancy	48.30 (24.66)	43.00 (24.04)	52.67 (20.87)
Pain intensity	20.32 (19.87)	14.68 (17.77)	18.00 (20.16)
Pain unpleasantness	31.55 (2.54)	29.20 (23.36)	33.61 (24.07)
Peak pain	2.59 (1.14)	2.29 (1.52)	2.44 (1.52)
Sensory pain	7.37 (6.24)	6.51 (5.98)	6.51 (5.58)
Affective pain	.68 (1.62)	.59 (1.07)	.56 (1.36)
Evaluative pain	.34 (.85)	.71 (1.36)	.22 (.99)
Miscellaneous pain	1.88 (2.17)	2.39 (2.72)	1.02 (1.72)
Coping			
Reinterpretation	1.46 (1.66)	1.71 (1.39)	1.88 (1.65)
Diverting attention	2.10 (1.88)	1.41 (1.91)	1.88 (1.87)
Ignoring	2.15 (1.88)	2.39 (2.02)	2.20 (1.71)
Self-statements	3.86 (1.90)	3.73 (1.95)	3.56 (1.73)

TABLE 2. Mean (*SD*) affect before and following colposcopy in each of three attention strategy groups (*n* = 123)

Variable	Group	Before	After
State anxiety	Distraction	47.32 (11.80)	37.73 (9.82)
	Sensory Focus	43.10 (12.94)	32.90 (11.24)
	Control	44.49 (11.81)	34.88 (9.87)
Positive affect	Distraction	26.51 (7.48)	25.37 (9.04)
	Sensory Focus	28.15 (6.64)	28.66 (9.23)
	Control	26.80 (7.39)	26.63 (8.99)
Negative affect	Distraction	18.61 (5.92)	14.59 (5.26)
	Sensory Focus	18.12 (6.81)	13.27 (4.52)
	Control	17.54 (5.46)	13.75 (4.31)