Acceptance as a process variable in relation to catastrophizing in multidisciplinary pain treatment

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Abstract

Background: The underlying processes of change that contribute to the effectiveness of multidisciplinary pain treatment require clarification. Previous research has found support for pain acceptance as a process variable in acceptance-based treatment. Preliminary findings indicate that pain acceptance may also be a process variable in traditional cognitive behavioural therapy (CBT). The aim of this study was to

investigate the role of pain acceptance as a process variable in CBT relative to two empirically supported process variables, namely catastrophizing and pain intensity.

Methods: Patients with chronic pain (n = 186) attended a 3-week, multidisciplinary pain programme, which was CBT based. Patients completed a measure of pain intensity; the Chronic Pain Acceptance Questionnaire; the catastrophizing subscale of the Pain Response Self-Statements Scale; the Roland Morris Disability Questionnaire; the Depression Anxiety and Stress Scale; and two measures of physical functioning at pretreatment, post-treatment and 3-month follow-up. Results: Both acceptance and catastrophizing showed statistically significant and clinically relevant changes from pre to post-treatment. Changes in both acceptance and catastrophizing showed a significant correlation with changes in almost all of the outcome variables. Regression analyses demonstrated that change in acceptance was a significant predictor of changes in depression, disability, timed walk and sit-to-stand performance, after controlling for changes in catastrophizing and pain intensity.

Conclusions: Although not specifically targeted in CBT treatment, acceptance of pain was an important process variable that contributed to CBT treatment outcomes after controlling for changes in pain intensity and catastrophizing. Implications for future research and clinical practice are discussed.

1. Introduction

Acceptance of chronic pain is an important concept in pain research. McCracken et al. (2004) developed a definition of pain acceptance based on two related behavioural processes. The first process relates to the engagement in activities of personal value even when pain is present; the second relates to the willingness to give up attempts to avoid or control pain. Cross-sectional studies have found a positive correlation between pain acceptance and higher levels of emotional and physical functioning (McCracken et al., 2004). Furthermore, studies have demonstrated significant improvements in outcomes following acceptance-based treatment (McCracken et al., 2005). Research has indicated that pain acceptance underlies patient improvement (i.e., is a process variable) in acceptance-based

treatment. Vowles et al. (2007) explored the relationship between acceptance, catastrophizing and pain intensity as process variables in a treatment intervention that targeted acceptance. Change in pain intensity was controlled for in the analysis because it was considered a fundamental contributor to treatment outcomes in pain management. Change in catastrophizing and change in acceptance were the focal process variables of the study. Catastrophizing is a thinking style characterized by magnification, rumination and helplessness (Sullivan et al., 2001). It has strong theoretical and clinical associations with avoidant behaviour (Vlaeyen et al., 1995) and it is recognized as a key process variable in traditional cognitive behavioural therapy (CBT; Jensen et al., 2007). Vowles et al. (2007) found that change in acceptance made significant contributions to the variance in changes in outcomes after controlling for changes in pain intensity and catastrophizing.

Early findings from comparison studies have indicated that changes in pain acceptance may also underlie patient improvement in traditional CBT, even though CBT does not target acceptance. In a pilot study (n = 11), Vowles et al. (2009) compared CBT with acceptance and commitment therapy (ACT; Hayes et al., 1999). Results showed significant change in pain acceptance across both approaches. In a larger sample (n = 114 randomised; n = 99 commenced treatment), Wetherell et al. (2011) found that both ACT and CBT had positive effects on acceptance. The focus of these studies was the comparison of treatment effectiveness. An analysis of the unique contribution of acceptance to outcomes in relation to other process variables was not conducted. Traditional CBT emphasizes changing maladaptive cognitions to improve emotional and physical functioning (Hayes, 2008); it aims to reduce cognitions such as catastrophizing. Therefore, comparing acceptance to catastrophizing is particularly relevant when evaluating the contribution of acceptance to outcomes in traditional CBT.

Our broad aim was to investigate whether acceptance functioned as a process variable in CBT when considered in relation to other process variables that have gained empirical support. Identification of process variables (e.g., acceptance) that span therapeutic approaches will help refine clinical procedures. It will also highlight key change processes to monitor and emphasize during pain programmes. We employed a comparable methodology to Vowles et al. (2007); an important difference, however, was that our intervention was based on traditional CBT. We

examined the contribution made by change in acceptance to changes in outcomes, when considered in relation to the contributions made by changes in catastrophizing and pain intensity.

2. Method

2.1 Participants

Participants in this study were 186 adults (54.3% female) with chronic pain who attended a public hospital-based, 3-week, intensive, outpatient, pain management programme, which was multidisciplinary and based on traditional CBT. Potential participants were assessed on the basis of inclusion criteria that required that the patients were over 18 years of age; had experienced chronic pain for over 3 months; had not responded to (evidence-based) medical or surgical treatment; and had approval from their insurance companies for payment of treatment costs. Exclusion criteria included patients who were seeking alternative, invasive treatment such as surgery, presence of a psychotic disorder and threats or history of self-harm. If patients were using medication, they were required to be on a stable dose prior to commencement of the programme. Potential participants were screened physically and psychologically by a pain physician and psychologist.

Of 417 patients assessed by the unit, 186 met the inclusion criteria (including insurers' payments) and were admitted to the programme. Retention was high, with 176 (95%) completing the programme. Reasons for programme withdrawal were family (n = 3); interpersonal difficulties in the group environment (n = 2); significant increase in pain intensity (n = 1); physical ill health (n = 3); and reasons relating to mental health (n = 1). Questionnaire completion rates were high, with 182 (97%) completing the measures at commencement, 164 (88%) at the end of the 3-week treatment period and 114 (61.2%) at the 3-month follow-up. The mean age at commencement of the programme was 43.5 years [standard deviation (SD = 9.6)]. Just under half of the participants (42.7%) had not completed high school and 7.6 % had completed a university degree. Mean duration of chronic pain was 2 years 6 months (SD = 3 years 3 months) and mean number of months since last participating

in any type of work was 3 months 2 weeks (SD = 4 months). The mean self-reported usual pain intensity over the past week was 6.5 (where 0 was no pain and 10 was worst possible pain; SD = 1.7). The most commonly identified primary pain site was low back (44.4%). Other primary pain sites were upper shoulders and limbs (16.3%); head, face and mouth (10.5%); cervical spine (9.8%); full body (9.8%); lower limbs (6.5%); thoracic spine (3.3%); and pelvis and other (0.7%). Approximately half of the sample was unemployed, with the remainder in a work trial or working (full-time or part-time). The initiation of pain for approximately 75% of participants was work related.

2.2 Measures

2.2.1 Process measures

2.2.1.1 Pain intensity

Pain intensity was measured on a numerical rating scale (NRS) that ranged from 0 (no pain) to 10 (worst possible pain). Ratings were given for the average daily pain in the last week. The NRS has been shown to be a valid and sensitive measure when used to assess change in pain intensity (Ferreira-Valente et al., 2011).

2.2.1.2 Acceptance of pain

The Chronic Pain Acceptance Questionnaire (CPAQ; McCracken et al., 2004), which consists of 20 items, was administered as part of the assessment battery. The CPAQ has two subscales: activity engagement (e.g., 'I am getting on with the business of living no matter what my pain level is') and pain willingness (e.g., 'I would gladly sacrifice important things in my life to control this pain better'). Questions are rated on a scale from 0 (never true) to 6 (always true). The internal consistency has been reported as ranging from 0.78 to 0.83 (Reneman et al., 2010). Cronbach's alpha for the present study was 0.85. The validity of the CPAQ has been reported in a number of studies that show that the CPAQ is correlated with a number of measures of patient functioning (McCracken, 1998; McCracken et al., 2004; see Reneman et al., 2010, for a review of the psychometric properties of the CPAQ).

2.2.1.3 Pain catastrophizing

Pain catastrophizing was measured using the nine items of the Pain Response Self-Statement Scale (PRSS) that relate to pain catastrophizing (Flor et al.,

1993). The questionnaire lists typical thoughts of people in pain (e.g. 'I cannot stand this pain any longer'). Questions are rated on a 6-point scale ranging from 0 to 5 with higher scores indicating more frequent catastrophizing when experiencing pain. The PRSS has been reported to have good psychometric properties (Flor et al., 1993). A previous study reported Cronbach's alpha for the catastrophizing subscale of the PRSS as 0.92 (Flor et al., 1993). Cronbach's alpha for the catastrophizing subscale of the PRSS in the present study was 0.85.

2.2.2 Outcome measures

2.2.2.1 Functional disability

The Roland Morris Disability Questionnaire (RMDQ) is a 24-item scale that measures functional disability (Rolland and Morris, 1983). The items relate to a range of daily activities that patients may perceive are limited by pain. Total scores range from 0 (no disability) to 24 (severe disability). A modified version of the RMDQ was used in this study, with references to pain in general being substituted for references to a specific injury site (e.g., 'I walk more slowly because of my pain'), so as to be suitable for use with all pain locations. The reliability and validity of the modified measure has been established in a chronic pain population (Asghari and Nicholas, 2001); in a previous study employing the modified RMDQ in a chronic pain sample at a tertiary referral pain centre, Cronbach's alpha was 0.92 (Asghari and Nicholas, 2001). Cronbach's alpha for the modified RMDQ in the present study was 0.83.

2.2.2.2 Depression and anxiety

The Depression Anxiety and Stress Scale 21 (DASS21) is a measure of depression, anxiety and stress consisting of 21 items (Lovibond and Lovibond, 1995). The depression scale consists of seven items. The scale does not include somatic symptoms and is therefore useful in chronic pain populations to avoid the confounding of the measurement of depression by somatic symptoms that may relate to the pain problem. Items include 'I couldn't seem to experience any positive feeling at all' and 'I felt I had nothing to look forward to'. The anxiety scale consists of seven items and includes autonomic arousal, skeletal muscle effects, situational anxiety and subjective experience of anxious affect. Items include 'I experienced trembling (e.g., in the hands)' and 'I felt I was close to panic'.

The internal consistency for the DASS has been shown to be good for the subscales of depression (a = 0.91) and anxiety (a = 0.84) in a non-clinical population (Lovibond and Lovibond, 1995). Cronbach's alpha in the present study was 0.92 for the depression subscale and 0.85 for the anxiety subscale. The validity of the DASS generally, and in chronic pain populations specifically, has been demonstrated (Lovibond and Lovibond, 1995; Taylor et al., 2005).

2.2.2.3 Physical measures

The distance a patient could walk in 5 min was recorded and the number of sit-to-stand repetitions performed in 1 min was also recorded. Physical measures have been found to moderately correlate with self-reported functional disability (Lee et al., 2001). The combination of self-reported activity limitation and physical measures provides unique and complementary information for the assessment of physical function (Lee et al., 2001).

The 5-min walk was conducted in an empty corridor with permanent marks placed 20 m apart. The 5-min walk has been shown to have good test-retest and inter-rater reliability in a chronic pain population and to be sensitive to change in functioning during a multidisciplinary pain programme (Harding et al., 1994). The sit-to-stand task was conducted in a chair without armrests and patients were not allowed to use their arms to assist them to perform the action (Harding et al., 1994). Patients were instructed to perform as many sit-to-stand actions as they could in 1 min; they were

told when 30 s had elapsed. The 1-min sit-to-stand test has been shown to have good test-retest and inter-rater reliability in a chronic pain population and to be sensitive to change in function during a pain programme (Harding et al., 1994).

2.3 Procedure

All participants completed assessment questionnaires at pretreatment, post-treatment and 3-month followup. The study was conducted in an outpatient pain clinic of a public hospital. Human ethical clearance was obtained from this hospital and from The University of Queensland. Written consent was provided by participants. The content of the manualized cognitive behavioural therapy programme was multidisciplinary in nature and included sessions with a physiotherapist, psychologist, pain physician and nurse. The content of the sessions was based on a cognitive behavioural programme by Nicholas et al. (2007). The physiotherapy component of the group-based treatment was based on cognitive behavioural principles and consisted of mobilizing exercises and activity; the activity components were graded exposure in vivo to activities that the patient avoided and graded activity as usual. The rationale provided to patients for the in vivo exposure was based on the fear-avoidance model (Vlaeyen and Linton, 2000; Leeuw et al., 2007; see Lohnberg, 2007 for a summary of CBT-oriented exposure-based treatment for chronic pain). The psychological component of the course consisted of cognitive restructuring, relaxation training, goal setting and education regarding chronic pain. Medical education sessions were conducted by the pain physician and nurse to answer questions such as 'What is chronic pain?' and 'What do X-rays, CT and MRI scans tell us?' as well as providing information about medications and chronic pain. Classes were conducted from 9:00 a.m. to 3:00 p.m., for 5 days each week, with groups ranging in size from 4 to 10 participants. Follow-up questionnaires were mailed out to participants 3 months after completion of the programme. Participants were required to attend the clinic in person at that time, in order to return questionnaires and for physical measures to be administered.

2.4 Data analytic strategy

The primary goal was to assess the relationship between process variables (pain, catastrophizing and acceptance) and key outcomes (depression, anxiety, disability, sit-to-stand and timed walk). In order to achieve this goal, a series of analyses were conducted. The first step was to perform t-tests, to determine whether the 186 patients who attended treatment significantly differed from those who were assessed by the service but not admitted for treatment during the period of data collection. Next, t-tests were performed to compare patients who completed questionnaires post-treatment with those who did not. Paired t-tests were then used to determine whether statistically significant changes in measures had occurred from pretreatment to post-treatment and from pretreatment to 3-month follow-up.

We next calculated within-subjects effect sizes (Cohen's d; Cohen, 1988) for all process and outcome variables, by subtracting the post-treatment score from the pretreatment score and dividing by the SD of the pretreatment score.1 We followed Cohen's (1988) guidelines for interpretation of the d statistic. Cohen (1988) suggested that d greater than 0.2 is a small effect, greater than 0.5 is a medium effect and greater than 0.8 is a large effect.

Residualized change scores were calculated using pretreatment to post-treatment scores for process variables, and pretreatment to post-treatment as well as pretreatment to follow-up scores for outcome variables. A correlation matrix was then calculated using the change scores. Finally, hierarchical multiple regressions were conducted for each outcome measure, entering change in pain at step 1, change in catastrophizing at step 2 and change in acceptance at step 3. The order in which change in catastrophizing and change in acceptance were entered was then reversed, so that contributions made by change in acceptance after controlling for change in pain inten sity could be evaluated. The contribution made by change in catastrophizing, after controlling for both change in pain and change in acceptance, was also assessed.

3. Results

3.1 Preliminary analyses

There were no statistically significant differences on key variables (age, gender, pain intensity, duration of pain, time since last worked, depression, anxiety, disability, acceptance and catastrophizing) between patients admitted to the programme and individuals assessed but not admitted; all ts(415) < 1.62, all ps > 0.1. At pretreatment, there were no statistically significant differences on key variables between those who completed the questionnaires at post-treatment and those who did not; all ts(176) < 1.55, all ps > 0.06.

3.2 Preto post-treatment/3-month follow-up changes

Table 1 shows the means and SDs on measures at pretreatment, post-treatment and 3-month follow-up. All changes between pretreatment and post-treatment were statistically significant; all ts(175) > 2.41, all ps < 0.001. Changes from pretreatment to 3-month follow-up were all statistically significant; all ts(113) > 3.18, all ps < 0.001. If a conservative alpha were applied to control for type I error (i.e., 0.05/ number of comparisons; 0.05/10 = 0.005), all analyses would continue to be significant.

3.3 Effect size calculations

Table 1 (right half) shows the Cohen's d effect sizes for all measures from pretreatment to post-treatment and from pretreatment to 3-month follow-up. The average effect size from pretreatment to post-treatment was 0.56 (range 0.15 to 1.03). From pretreatment to posttreatment, a large effect was observed for sit-to-stand; medium effects were observed for acceptance, activity engagement, catastrophizing, depression and disability; and small effects were observed for the remaining variables. From pretreatment to 3-month follow-up, the average effect size was 0.49 (range 0.27 to 0.85). A large effect was observed for sit-to-stand; medium effects were observed for acceptance, activity engagement, pain willingness, catastrophizing and disability; and small effects were observed for the remaining variables.

3.4 Treatment process analysis

Table 2 shows the Pearson product-moment coefficients for correlations between residualized changes in process variables (measured from pretreatment to post-treatment) and residualized changes in outcome variables (measured from pretreatment to posttreatment and from pretreatment to 3-month followup). From pretreatment to post-treatment, 24 of the 25 correlations between changes in process measures and changes in outcome measures were significant; while from pretreatment to 3-month follow-up, 19 of the 25 correlations between changes in process measures and changes in outcome measures were significant. The correlations between the process measures were not sufficiently high ($r < 0.6$) to raise concern about multicollinearity in subsequent regression analyses.

Table 3 (left half) shows a series of hierarchical regressions entering change in pain at step 1, change in catastrophizing at step 2 and change in acceptance at step 3. Table 3 (right half) shows regressions in which the order of catastrophizing and acceptance was reversed. From pretreatment to post-treatment, change in pain entered at step 1 significantly predicted changes in all outcome measures, except timed walk, and accounted for between 4% and 13% (M = 8%) of variance in changes on outcome measures. From pretreatment to 3-month follow-up, change in pain at step 1 significantly predicted changes in disability and sit-to-stand performance and accounted for between 1% and 7% (M = 4%) of variance in changes on outcome measures.

From pretreatment to post-treatment, change in catastrophizing significantly predicted changes in four out of the five outcome indices: changes in depression, anxiety, disability and sit-to-stand; it accounted for between 2% and 20% (M = 10%) of the unique variance in changes in outcomes after controlling for change in pain. From pretreatment to 3-month followup, change in catastrophizing predicted changes in all outcome indices and accounted for between 5% and 18% (M = 8%) of variance in changes in outcomes after controlling for change in pain.

To assess the unique contribution made by change in acceptance, this focal construct was entered into the model at step 3. From pretreatment to post-treatment,

change in acceptance was a significant predictor of the changes in four out of the five outcome indices: changes in depression, anxiety, disability and timed walk; it accounted for between 1% and 9% (M = 4%) of variance in changes in outcomes. From pretreatment to 3-month follow-up, change in acceptance was a significant predictor of changes in four out of the five outcome indices: changes in depression, disability, timed walk and sit-to-stand; it accounted for between 0% and 9% (M = 4%) of the variance in the change on outcome measures.

Next, the order of entry for catastrophizing and acceptance was reversed. Change in pain was again entered at step 1. From pretreatment to post-treatment, when change in acceptance was entered at step 2, it was a significant predictor of changes in all outcome indices and accounted for between 4% and 16% (M = 9%) of the variance in changes on outcome measures. From pretreatment to 3-month follow-up, change in acceptance at step 2 was a significant predictor of changes in depression, disability and sit-to-stand performance and accounted for between 2% and 16% (M = 10%) of the variance in changes on outcome measures.

The final set of analyses determined the unique contributions made by change in catastrophizing. Change in catastrophizing was entered at step 3. From pretreatment to post-treatment, change in catastrophizing was a statistically significant predictor of changes in depression, anxiety and disability, but it did not act as a predictor of changes in the two physical measures. Change in catastrophizing accounted for between 0% and 12% (M = 7%) of variance in changes on outcome measures. From pretreatment to 3-month follow-up, change in catastrophizing was a statistically significant predictor of changes in depression, anxiety, disability and timed walk; it accounted for between 0% and 8% (M = 4%) of variance in changes on outcome measures.

3.5 Post hoc analyses

In order to test whether the changes observed for activity engagement and pain willingness from post-treatment to 3-month follow-up were statistically significant, two additional repeated-measures t-tests were conducted. Previous analyses indicated that activity engagement, $t(176) = -7.59$, $p = 0.001$, and pain willingness, $t(176) = -$

5.11, p = 0.001, showed statistically significant change from pretreatment to post-treatment. In the post hoc analyses, activity engagement showed a statistically significant decrease from post-treatment to 3-month follow-up, t(113) = 2.37, p = 0.02, but pain willingness increased by a statistically significant amount, t(113) = -3.17, p = 0.002 from post-treatment to 3-month follow-up. Cohen's d was also calculated over the same period for both subscales. Cohen's d was 0.20 for the decrease in activity engagement and -0.34 for the increase in pain willingness, from post-treatment to3-month follow-up.

4. Discussion

The results of this study indicate that changes in pain acceptance underlie patient improvements in traditional CBT treatment. Firstly, acceptance of pain showed a statistically significant improvement across the 3-week programme, despite acceptance not being targeted. This finding adds to those of Vowles et al. (2009) and Wetherell et al. (2011) by replicating a change in acceptance in response to CBT; however, the current study did so in a larger sample with a more intensive programme that was multidisciplinary.

Secondly, change in acceptance accounted for unique variance in the changes in all outcomes measured from pretreatment to 3-month follow-up after controlling for change in pain. This finding provides support for the view that acceptance of pain is an important construct in chronic pain treatment that has relevance beyond acceptance-based treatment; it is also in keeping with the notion that acceptance of pain is associated with emotional and physical functioning independent of the level of pain experienced.

Thirdly, change in acceptance was a significant predictor of changes in depression, disability, sit-to-stand performance and timed walk, measured from pretreatment to 3-month follow-up, after controlling for changes in both pain and catastrophizing. This study extends previous findings by identifying a unique contribution made by acceptance to CBT outcomes, when compared with two variables that have empirical support as process variables in CBT. Previous studies have suggested that acceptance may underlie patient improvement in traditional CBT; however, this is the

first study to show, using regression analysis, that change in acceptance makes a unique contribution to outcomes, when considered in relation to other process variables. While catastrophizing was explicitly targeted in the CBT intervention, acceptance of pain was not. Vowles et al. (2007) made a similar finding regarding the contribution of change in acceptance to outcomes; however, in contrast to the present study, their study explicitly targeted acceptance. Apart from the focus on acceptance, the studies were similar in that they were both intensive (daily attendance for 3 to 4 weeks), multidisciplinary, and group-based. The only difference in the results of the two studies was that Vowles et al. (2007) found that change in acceptance did not explain unique variance in changes on physical measures from pretreatment to 3-month follow-up. It would appear that change in acceptance makes important contributions to treatment effectiveness, whether targeted explicitly or not.

Finally, when the order of entry for catastrophizing and acceptance was reversed in regression analysis, change in catastrophizing was a unique predictor of changes in depression, anxiety, disability and timed walk from pretreatment to 3-month follow-up. Change in acceptance and change in catastrophizing both accounted for approximately the same amount of unique variance in change in outcomes. This finding is in line with the CBT treatment rationale and with previous findings that have identified catastrophizing as an important process variable in CBT (Jensen et al.,

2007). Although CBT-based approaches emphasize a reduction of internal experiences, such as catastrophizing, an equally important process appears to occur simultaneously; namely acceptance of pain. This additional effect appears to be an important ingredient, which adds to the effectiveness of the treatment.

Previous research has not considered how traditional CBT treatment affects the subscales of the CPAQ. Change in acceptance across the CBT intervention was comprised of changes in both activity engagement and pain willingness. However, a larger effect size was obtained for change in activity engagement across the intervention ($d = 0.67$) than for pain willingness ($d = 0.38$). The improvement in acceptance may have been due to the effect of the exposure component. Exposure was a substantial part of the CBT treatment. In CBT-based exposure, gradual engagement in an activity allows the challenging of unhelpful expectations about

activity and pain. This process may have promoted a behavioural tendency to engage in activities in the presence of pain. Although this explanation is consistent with an increase in the activity engagement component of acceptance, it does not explain the increase in pain willingness. An important point is that pain acceptance entails more than activity engagement in the presence of pain; it also involves a willingness to have uncomfortable experiences in the pursuit of important goals (McCracken, 2005a, 2010). ACT-based treatment explicitly targets pain willingness through direct discussion of willingness, mindfulness practice, the use of metaphors and behavioural activities undertaken with the goal of practicing pain willingness (Dahl et al., 2005).

In contrast to the findings from pre to posttreatment, the increase in pain willingness from pretreatment to 3-month follow-up (d = 0.73) was greater than the increase in activity engagement (d = 0.47) over the same period. Furthermore, there was a statistically significant decrease in activity engagement from post-treatment to 3-month follow-up (d = -0.21), whereas there was a statistically significant increase in pain willingness from post-treatment to 3-month follow-up (d = 0.34). A possible explanation for the increase in pain willingness is that after the programme, patients may have focused less on reducing their pain experience when they participated in meaningful activities. As an example, a patient who returns to work after the programme may focus more on this aspect of their life rather than on controlling their pain. Similarly, as their pain experience reduced, patients may have focused less on controlling pain. Nevertheless, the finding suggests that in traditional CBT, clinically relevant changes in pain willingness may not occur until after completion of the programme. This appears to present a problem for patients who are primarily focused on avoiding their pain. Without explicitly addressing their pain control agenda in CBT treatment, patients may struggle with the relevance of exposing themselves to pain.

This study has some limitations that are worth noting. Firstly, the treatment-seeking sample in our study was a homogenous group in terms of disease range, severity and capacity for insurer-funded intensive treatment. Further studies are required across a broader profile of individuals experiencing chronic pain to determine the role of acceptance in CBT. Secondly, without a control group, it was not possible to differentiate the direct effect of the treatment from other possible influences.

Future research could focus on whether including acceptance-targeted techniques in CBT programmes improves pain acceptance and whether this improves the overall effectiveness of the programme. In support of this notion, the effect size for acceptance in the current study (d = 0.66) was considerably smaller than that in a recent ACT-based study (McCracken and Gutierrez-Martinez, 2011; d = 1.61). Similarly, studies could also examine whether treatment response to acceptance-based interventions and CBT differs depending on patients' pretreatment level of pain willingness. Treatments, which target acceptance, may provide a more efficient and effective alternative for patients whose pain willingness is particularly low prior to treatment. Clarification of this will require large sample comparison studies. Finally, future research could, over an extended follow-up period, also examine acceptance as a process variable in relation to other variables relevant to traditional CBT, such as kinesiophobia and pain self-efficacy.

This study identified pain acceptance as an important behavioural pattern underlying patient improvement in CBT. Change in pain acceptance contributed to outcomes even after controlling for changes in catastrophizing and pain intensity. Pain acceptance and catastrophizing both contributed equally to CBT outcomes. The conditions under which explicitly targeting acceptance is more effective and efficient remains an important empirical question. It is likely that some integration of CBT and ACT strategies will occur over time. At the level of processes of change, the approaches appear compatible. An important consideration will be to apply techniques in a coherent way that focuses on the function of the techniques on important processes. ACT-related processes, such as acceptance, are underpinned by a theoretical perspective (relational frame theory) and a philosophical perspective (functional contextualism).2 These perspectives provide suitable frameworks in which to combine acceptance-based and CBT techniques in a coherent way, based on the function (i.e., consequence) of the techniques on important processes variables. In current clinical practice, measuring pain acceptance within a traditional CBT-based programme provides clinically relevant information about progress within treatment that is linked to longer term improvements in both emotional and physical functioning.

Author contributions

1 The calculation of the effect size statistic using means and standard deviation from uncontrolled pretreatment and post-treatment data may potentially overestimate the size of the effect in comparison with a controlled effect size (see Dunlap et al., 1986). However, calculation using the Cohen's d formula in the present study allows comparison to previously reported studies.

2 For an overview of relational frame theory and functional contextualism, see Hayes et al., 2012.

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