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Pain Acceptance Moderates the Relation Between Pain and Negative Affect in Osteoarthritis and Fibromyalgia Patients

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Abstract

Background—Chronic pain is often intractable despite advanced medical and psychotherapeutic treatments. Pain acceptance is emerging as a promising complement to control-based pain management strategies and a likely approach to maintaining quality of life for chronic pain patients.

Purpose—This theoretically-based analysis of an existing database examined the extent to which pain acceptance predicted weekly reports of positive affect (PA) and negative affect (NA), and the relations of pain severity to both PA and NA.

Methods—Participants were women, 35 with osteoarthritis and 75 with fibromylagia, who completed an initial assessment for demographics, pain catastrophizing, and pain acceptance, and 8 −12 weekly assessments of pain severity, PA, and NA.

Results—Multilevel modeling analyses indicated that pain acceptance was related to higher levels of PA but was unrelated to NA. Furthermore, pain acceptance moderated the relation of NA and pain severity, such that expected increases in NA during pain exacerbations were buffered by higher levels of pain acceptance.

Conclusions—These findings suggest that pain patients with greater capacity to accept pain may be emotionally resilient in managing their condition.

Chronic pain is a pervasive and challenging health condition that affects between 15% and 46.5% of the general adult population around the world (1-4). Traditionally, strategies for dealing with chronic pain have emphasized elimination or reduction of the pain sensation. Despite the wide use of medical interventions, particularly analgesics, as well as psychotherapeutic pain coping strategies, such as relaxation, complete and lasting pain relief is very rare (5). Efforts to identify alternative approaches to understanding and promoting successful pain management have identified pain acceptance as a potent correlate of positive physical and psychosocial adjustment to chronic pain (6-11).

As the definition of pain acceptance has evolved over time, two important components have emerged. The first component is an openness or willingness to experience pain sensations and the second is the pursuit of goals and activities despite having pain (12,13). For chronic pain patients whose situation is aversive yet unchangeable, efforts directed at changing the situation may be fruitless and potentially demoralizing. Pursuit of pain relief can be continuous, consuming a person's energy and time and directing those resources away from fulfilling life goals, experiencing positive events, and developing social connections. Simply put, pain acceptance involves intentionally allowing *some* pain *some of the time* (13) rather than attempting to control pain, as part of a broad-based goal to achieve and maintain quality of life.

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A recent study of the relation of pain acceptance to pain attention provides clues to how pain acceptance may lead to adaptation (10). The findings revealed that, in aggregated daily diary data acquired from pain patients, pain acceptance was related to less attention to pain but was not significantly related to ignoring pain. Moreover, pain acceptance was related to more efficacy to achieve, engagement with, and motivation to complete daily activities (10). The available data suggest that those who report more pain acceptance are freed from frequently attending to pain, which allows them to have a positive life focus and increased ability and drive to be active in daily life.

Traditionally, coping has been the focus of chronic pain research. There is some evidence that the benefits of pain acceptance extend beyond those of widely studied coping strategies. In one study of pain clinic patients, pain acceptance was not highly correlated with six common types of pain coping, including diverting attention and increasing activity, and was a stronger predictor of adaptation than coping, across seven outcome variables (6). In fact, a recent reanalysis of these data showed that, compared to five standard coping variables, acceptance accounted for approximately six times the variance across seven measures of physical and psychosocial functioning (11). These results indicate that acceptance is a unique means of responding to pain that appears to be more predictive of some indicators of pain adaptation than pain coping.

Research on the apparent benefits of pain acceptance for pain patients' quality of life is encouraging. Pain acceptance has been found to relate to less pain intensity and psychological distress (e.g. depression and pain-related anxiety), improved physical functioning, and general mental well-being (6-9). Yet to date, the studies that have assessed the relation of pain acceptance and adjustment to pain are limited by cross-sectional designs, aggregation of longitudinal data, and samples that consist primarily of back pain patients. Moreover, available data do not give us information about the role of pain acceptance in either adaptation in the context of changes in pain severity over time or about individual responses to pain.

Also missing from published studies to date is an examination of how pain acceptance helps chronic pain patients sustain quality of life. Chronic pain has been found to increase negative and decrease positive affect (14,15). This is troubling news for chronic pain patients, because the experience of low negative relative to positive affect is so central to quality of life and mental well-being (16). Because negative affect and positive affect correspond to other indicators of adaptation to chronic pain and are independent indicators of quality of life, they are important outcomes to consider.

Among the most widely studied and potent predictors of pain adjustment is pain catastrophizing. Catastrophizing is characterized by ruminations about a specific worry, feelings of vulnerability and helplessness, and the perception that the situation is escalating to a increasingly worse outcome (17). A large body of literature has consistently revealed that pain catastrophizing is related to higher psychological distress, pain ratings, and functional disability (18,19). Because the attributes and impacts of pain catastrophizing and pain acceptance suggest that the two may be inversely related, catastrophizing was included in the analyses to probe whether pain acceptance is simply the absence of pain catastrophizing.

To further elaborate the relations between pain acceptance and adaptation to pain, the present study used repeated observations of pain and affect to examine whether pain acceptance moderates the relation between pain severity and both positive affect and negative affect in the daily lives of people living with osteoarthritis (OA) or fibromyalgia syndrome (FMS).

Methods

Participants

Participants were female residents of the Phoenix, Arizona metropolitan area who were recruited to participate in a study of chronic pain through flyers placed in physicians' offices and other public locations, physicians' recommendation to their patients, newspaper ads, senior citizens' groups, arthritis groups, and mass mailings to members of the Arthritis Foundation. To be eligible, participants had to be diagnosed after 1988 and could not be involved in any health-related litigation. In addition, all participants were required to be living with a romantic partner, a criterion developed for a separate phase of the study. Of the 332 participants who were screened, 130 (39%) did not meet eligibility criteria and an additional 19 (9%) were eligible but refused to participate. A total of 183 women initially were enrolled in the study. Of those, 125 (68%) completed the assessments from which data for the current study were drawn and 110 completed an initial questionnaire and at least eight weekly interviews. An extensive description of ineligibility, refusal, and attrition rates is published elsewhere (16).

Participants were 110 females between the ages of 35 and 72 years (M = 54.57, SD = 8.37), with a diagnosis of OA (n = 35) or FMS with or without OA (n = 75). Pain diagnoses were confirmed by participants' physicians and participants who had FMS and OA had to report that FMS was the arthritis that "gives you the most difficulty" to be considered part of the FMS group. All completed at least 8 and a maximum of 12 weekly interviews. The average number of completed weeks per participant was 10.31 weeks (SD = 1.08). The majority of participants were Caucasian (95.4%) and married (89.2%). Approximately two-thirds of the sample (66.9%) had completed at least one year of college and 97.7% of participants had graduated from high school. The median household income range was $60,000−$69,999, and 38.2% of the women were employed. The average number of years since diagnosis was 8.59 (range = 0 −46, SD = 9.14) for OA patients and 5.32 (range = 0−36, SD = 4.63) for FMS patients. Pain severity among participants was significant. Over half (54.5%) reported back pain. Moreover, on a 101-point scale ranging from 0 (no pain) to 100 (pain as bad as it can be), the mean level of average weekly pain was 48.13 (SD = 19.63) for OA patients and 55.43 (SD = 15.81) for FMS patients. On the Pittsburgh Sleep Quality Index (range = 0 − 20, lower numbers indicate better sleep quality) (20), both groups met criteria for disturbed sleep (OA M = 7.03, SD = 3.48; FMS M = 10.75, SD = 3.94), and on a 101-point scale ranging from 0 (no fatigue) to 100 (fatigue as bad as it can be) the mean level of weekly fatigue was 46.65 (SD = 19.64) for the OA and 60.04 (SD = 15.46) for the FMS group. As a whole, then, the sample reported moderate levels of pain, sleep problems, and fatigue.

Procedure

The data for this analysis were obtained from a multiyear project assessing a range of mental and physical health variables. There were 5 major components of the study: Initial Questionnaire, Weekly Interviews, Stress Visit, Laboratory Testing, and Follow-up Assessment. This theoretically-based analysis made use of existing data from the initial questionnaire and 8−12 weeks of weekly telephone interviews conducted by trained research assistants. All participants signed and mailed in consent forms prior to completing their initial questionnaire and beginning their weekly interviews.

Measures

Pain Acceptance—Pain acceptance was assessed in the initial questionnaire using 10 items published by McCracken (8) as a sample from the original 34-item CPAQ (21). Table 1 displays the items, participant instructions, and answer choices for the pain acceptance measure. Cronbach's alpha in the current sample was .72. The construct validity of the scale is suggested by correlations with standardized measures of distress (22,23) (Multidimensional Health

Inventory (MHI); depression $r = -.22$, $p = .02$; anxiety $r = -.24$, $p = .01$;) and adjustment (24) (Short-Form Health Survey (SF-36); physical functioning $r = .25$, $p = .01$; mental functioning $r = .29$, $p = <.01$). Additionally, in a sample of 327 chronic pain patients, the correlation of the 10-item CPAQ scale with the complete 24-item CPAQ was $r = .77$, $p < .01$ (L. M. McCracken, personal communication, December 18, 2005). The 12-month test-retest reliability for the 10-item pain acceptance scale in a separate dataset of 74 rheumatoid arthritis patients was $r = .59$, $p < .01$. These findings indicate that the 10-item CPAQ scale demonstrates acceptable internal reliability and test-retest reliability over a significant interval.

Pain Severity—The *Worst Pain* experienced in the week preceding each weekly phone interview was assessed with the standard numerical pain rating scale (25). Participants were asked to "choose a number between 0 and 100 that best describes the worst level of pain [you have] experienced over the past week due to [your] fibromyalgia/osteoarthritis." Phone interviewers indicated to participants that a zero (0) would mean "no pain" and a one hundred (100) would mean "pain as bad as it can be." In addition to weekly worst pain, we measured weekly *Average Pain* using comparable language. The multilevel analyses were run for both measures of weekly pain, yielding identical patterns of significant findings. For brevity, only the results for weekly worst pain are presented here. (The data for average pain are available from the first author upon request.)

Positive and Negative Affect—During each weekly phone interview, participants were asked to rate affect terms from the Positive and Negative Affect Schedule (PANAS) (26) on a 5-point scale (1 = "Very slightly or not at all" to 5 = "Extremely") to indicate the extent to which they experienced positive (PA) and negative affect (NA) during the week preceding the phone interview. The mean of 10 positive affect items represents the PA scale score and the mean of 10 negative affect items represents the NA scale score. To estimate within-person reliability, item values were transformed into z-scores representing deviations from each participant's own mean score across the weeks. The resulting z-scores were therefore independent of between person-differences in level and variability and were used to calculate within-person reliability. The within-subject alpha for PA was .85 for and for NA was .86. For the estimation of the reliability of the scale across participants, averages of each person's score on an item across weeks was computed, resulting in a mean score for each subject for each item. The between-subject alpha for PA was .94 and for NA was .91.

Pain Catastrophizing—Pain catastrophizing was assessed in the initial questionnaire with the four-item catastrophizing scale of the Vanderbilt Multidimensional Pain Coping Inventory (VMPCI) (27). The items in this scale were taken verbatim from the 6-item pain catastrophizing scale of the well-established and validated Coping Strategies Questionnaire (CSQ) (28) and incorporated into the VMPCI. Participants were asked to rate the frequency with which they had specified thoughts or engaged in specified behaviors when they experienced physical pain. Frequency ratings ranged from 1 ("I never do this when I am in pain") to 5 ("I very frequently do this when I am in pain"). The four catastrophizing items were "Think it is terrible, and that it is never going to get any better," "Worry the whole time about whether it will end," "Feel like I can't stand it any more," and "Feel like I can't go on." Total catastrophizing scores were calculated by averaging each participant's responses on the four items. Cronbach's alpha for this scale was .84 in the current sample. The construct validity of the scale was suggested by correlations with other measures of adaptation in this sample. Pain catastrophizing correlated negatively with pain acceptance ($r = -.19$, $p = .05$) and Purpose in Life (29) ($r = -.29$, $p < .01$) and positively with Pain Helplessness (30,31) ($r = .64$, $p < .01$), depression (MHI; $r = .42$, $p < .01$), and anxiety (MHI; $r = .38$, $p < .01$).

Data Analysis

Preliminary data analyses were conducted to examine descriptive properties of key variables. Weekly data were averaged for each participant for these initial analyses. Correlations between key study variables are presented in Table 2. Overall, low levels of NA were reported in this sample (M = 1.69, SD = .63) such that NA was negatively skewed (skewness = 1.35, kurtosis = 1.88). A natural log transformation was performed on the NA variable to correct the skew (skewness = .58, kurtosis = −.33) and all analyses were performed with this transformed value. We also examined differences between diagnostic groups in levels of key variables. OA and FMS patients were similar in average levels of NA (OA M = 1.60, SD = .38; FMS M = 1.76, SD = .48) and pain acceptance (OA M = 3.70, SD = .86; FMS M = 3.70, SD = .82), but OA patients had lower average worst pain (OA M = 60.03, SD = 22.36; FMS M = 71.09, SD 13.76), lower catastrophizing (OA M = 2.16, SD = .82; FMS M = 2.57, SD = .93), and higher PA (OA M = 3.13, SD = .55; FMS M = 2.59, SD = .57) than did FMS patients. Diagnostic differences were probed further in the multilevel analyses of the study hypotheses, reported below.

The hypotheses of the study were tested using multi-level random effects modeling. This means of analysis is particularly useful for data that have a hierarchical structure, in this case 8−12 weekly observations nested within each of the 110 participants. In addition, this method is able to account for variation both within each person and between persons and to control for the correlation between observations from consecutive weeks (i.e., autocorrelation). All analyses were completed using the SAS PROC MIXED software (32). SAS PROC MIXED uses a missing data handling procedure referred to as direct maximum likelihood, in which all cases are included in the analysis, regardless of how many assessments were observed. This procedure, that assumes data are “missing at random,” or that the “cause” of missing data at a particular time point is explained by one's scores at previous time points, has been referred to as “state of the art” in the methodological literature (33).

Before beginning the multi-level analyses, we centered all of the predictor variables according to the recommendations of Aiken & West (34) to reduce multicollinearity among the predictors, facilitate interpretation of interactions, and aid in understanding between- and within-person effects (35). Centering each variable was also a theoretical decision (36) that allowed us to ask whether being a person of average, below average, or above average pain acceptance (compared with the rest of the sample) impacts the relation of negative affect to pain severity on days of average, below average, or above average pain for the individual. Variables collected during the weekly interviews were person-centered and represented weekly deviations from each individual's mean score over the entire measurement period. Variables collected at one point in time, pain acceptance and catastrophizing, were centered around the grand mean of the sample by subtracting the sample's average from each woman's score on that measure.

Weekly predictions were made on two levels. The level one (within-person) equations are linear models that estimate the relation between the repeated measures for individual participants. The level two (between-persons) equations estimate individual differences in the level 1 intercepts and slopes as a function of the between-persons variables. The multi-level procedures followed the guidelines presented by Singer (35).

The Level 1 equations that predicted PA and NA were identical and was as follows:

$$\text{Level 1: weekly positive (negative) affect} = \beta_0 + \beta_1 \; \textit{centered worst pain} + r$$

β_0 gives an estimate of the average weekly PA or NA, and β_1 is the estimated slope of the effect of worst pain on affect. This equation contains one random effect, the within-subjects residual/error (r). Essentially, these Level 1 equations address the question *“when”:* for example: “*When* a person has a week of intensified pain, do they report lower positive affect?”

Rather than asking *"when"*, Level 2 equations essentially ask the question *"who"*: for example, "Do people *who* report high pain acceptance show more positive affect?" The Level 2 analysis consisted of a pair of equations that were identical in predicting positive affect and negative affect. The first Level 2 equation was as follows:

$$\text{Level 2: } \beta_0=\gamma_{00}+\gamma_{01}\ \text{sample centered pain acceptance}+\gamma_{02}\ \text{age}+\gamma_{03}\ \text{diagnosis}+\gamma_{04}\ \text{average worst pain}+\gamma_{05}\ \text{centered negative (positive) affect}+\gamma_{06}\ \text{sample centered catastrophizing}+u_0.$$

This Level 2 equation tested for differences in the slope of β_0 from the Level 1 equation. In this equation, γ_{00} , the grand mean of all the intercepts, was specified as a random effect, allowing for generalization to a larger population of people. Both Level 2 equations included an additional random effect, the between-subjects error or deviation of each subject's mean from the grand mean: u_0.

The models controlled for five key demographic and independent variables potentially relevant to the pain-affect association: age, diagnosis, average levels of pain, catastrophizing, and the other affect. Average worst pain was included as a control variable because there was a large range of average pain levels and an individual's typical level of pain may influence the relation of weekly changes in pain with affect. In addition, catastrophizing was included in the model as a control variable to determine whether the moderating effects of pain acceptance on the pain-affect associations were evident over and above catastrophizing.

The second level 2 equation was as follows:

$$\text{Level 2: } \beta_1 = \gamma_{01} + \gamma_{11}\ pain\ \ acceptance + u_0$$

In this Level 2 equation, β_1 provided the estimated slope between worst pain and affect (positive or negative) for each individual. This variable was predicted by individual differences in level of pain acceptance. Together, these equations tested interactions between individual differences on pain acceptance, and the influence of the Level 1 variable, centered worst pain, on positive and negative affect. These cross level interactions ask both *"who"* and *"when"* together: for example, "Do people *who* report high versus low pain acceptance have higher positive affect *when* pain intensifies?"

The models predicting PA and NA are "mixed models" because they account for both fixed effects, which assume that the independent variable represents all possible values one wants to make inferences about, and random effects, which assume that an independent variable represents a random sample of a larger universe of possible values. Allowing effects to vary randomly allows us to generalize to a population of people, observations (from samples of weekly interviews), and within-person processes (37).

Results

Tests of Study Hypotheses

The initial analyses tested whether pain acceptance interacted with weekly changes in pain to predict affect. In the mixed model predicting positive affect, centered worst pain showed significant random variance ($z = 1.79$, $p = .037$) and was therefore specified as a random effect variable. The results from analyses with positive affect as the dependent variable are presented in Table 3. Following the recommendations of Singer (35), we calculated both the within-person variance (5%) and the between-person variance (11%) accounted for by this model. Pain acceptance was significantly related to greater PA ($\beta = .22$, $p < .01$). Centered weekly worst pain was related to decreased PA, indicating that weekly variations in pain severity do predict weekly variations in PA. Contrary to our hypothesis, the interaction between pain acceptance and centered worst pain did not achieve significance; thus, pain acceptance did not

mitigate the expected decreases in PA in the context of pain exacerbation. Also noteworthy, average weekly worst pain level was not significantly related to positive affect with centered negative affect in the model, suggesting that individual differences in pain level beyond the effect of negative affect do not account for differences in positive affect between people.

In the mixed model predicting NA, centered worst pain did not show significant random variance ($z = .35$, $p = .36$) and therefore was not included as a random effect variable. The results from analyses predicting negative affect are presented in Table 4. The model accounted for 4% of the within-person variance, and none of the between-person variance. Consistent with our hypothesis, pain acceptance moderated the relation between centered worst pain and NA, such that the relation between weekly pain flares and weekly increases in NA was diminished with higher levels of pain acceptance. This interaction is depicted in Figure 1. Notably, pain acceptance moderated the relation of pain to NA over and above the influence of catastrophizing. In contrast to findings for PA, no main effect of pain acceptance on NA was observed. Centered worst pain was significantly related to increased NA, independent of PA and average worst pain.

To probe for differences between FMS and OA patients in the association between pain acceptance, pain severity, and affect, interaction terms including diagnosis were included in the models for both PA and NA. None of the interaction terms achieved significance, indicating that the patterns of associations hold for both diagnostic groups.

We conducted post hoc analyses to explore the possibility that positive affect accounted for a portion of the moderating effect of pain acceptance on the relation of weekly pain severity and negative affect. An additional interaction term containing positive affect, which had previously demonstrated a moderating role on pain severity and negative affect in this sample (16), was included in the equation predicting negative affect. Results showed that with the positive affect X pain severity term in the equation, ($\beta = -.004$, $t = -2.56$, $p = .01$), the pain acceptance X pain severity interaction diminished considerably in magnitude and became non-significant ($\beta = -.001$, $t = -.93$, $p = .35$). This suggests that pain acceptance indirectly impacts negative affect by way of increasing levels of positive affect.

Discussion

This study examined the relation between pain acceptance and adaptation to chronic pain, particularly during pain flares, in OA and FMS patients. Pain acceptance was a significant predictor of PA such that higher levels of pain acceptance were associated with higher levels of weekly PA. Consistent with expectation, pain acceptance moderated the association of weekly pain severity to weekly NA, such that expected rises in NA in the context of intensified pain were buffered by higher levels of pain acceptance. Contrary to expectation, pain acceptance did not have a significant main effect on weekly levels of NA and did not significantly moderate the relation between weekly pain severity and weekly PA.

How might pain acceptance reduce the power of pain to trigger negative emotions? Elevated and stable levels of positive affect associated with acceptance of chronic pain may act to buffer the impact of intensified pain, thereby decreasing the power of pain to precipitate negative emotions. Prior work has shown that people with overall higher levels of positive affect were less prone to experience increased negative affect in the context of a painful or interpersonally stressful week (16). Consistent with these findings, the impact of pain acceptance on the pain/negative affect relation was in part accounted for by positive affect, indicating that pain acceptance is a resilience factor. These findings are consistent with Fredrickson's (38) “broaden and build” theory of positive emotions which proposes that positive affect can help to fortify

one's coping repertoire, preparing one for future challenges and leading to an improved and swifter response to stressors, including chronic pain.

These findings highlight the independent nature of positive affect and negative affect and underscore the need for research on chronic pain coping to include measures of positive outcomes, such as positive affect (39). This may require a shift in the current chronic pain research paradigm that focuses largely on the reduction of negative outcomes, to a more comprehensive model that better reflects patient quality of life. Generally, chronic pain research begins with the assumption that the primary goal of patients is the reduction of pain and the increase of control over responses to pain. The pain acceptance literature, however, suggests that pain patients may be able to pursue happiness and fulfillment in life regardless of the extent to which they have been able to control their pain. In addition to exploring how people are able to mitigate the impact of chronic pain in their lives, researchers must turn to the question of how people live satisfying lives (i.e. how they are resilient) while living with chronic pain. Although pain acceptance is considered a type of adaptive coping, it does not reduce the likelihood of having negative emotions. This is consistent with findings that show that adaptive coping is related to increased positive affect, but has no influence on levels of negative affect (14).

All of the findings held after controlling for levels of pain catastrophizing. While there are indications that catastrophizing and pain acceptance are conceptually linked, the low correlation between the two ($r = -.19$, $p = .05$) and the effects of chronic pain acceptance on affect above and beyond the influence of catastrophizing in the current data suggest that pain acceptance is not simply a lack of catastrophizing pain cognitions. Pain acceptance seems to be comprised of two main facets: a willingness to experience pain and engagement with life activities (12). The engagement with life facet of pain acceptance, which is not directly conceptually related to catastrophizing, may be accounting for much of the unique influence of the pain acceptance variable. Future elaboration of the key components of chronic pain acceptance would help to clarify its relation to pain catastrophizing.

Together, these findings further our understanding of the ways in which pain acceptance modifies the impact of the pain experience on emotions. The correlation between pain acceptance and pain severity was relatively low ($r = -.28$, $p < .01$), indicating that pain acceptance is not simply a function of low pain. Pain acceptance relates to an overall increase in the experience of positive affect and a lessening of the connection between pain severity and negative affect. These emotional benefits of pain acceptance indicate that accepting pain is not an act of giving up, resigning, or surrendering to pain, all of which would likely lead to less positive and more negative affect. Rather, the positive emotional benefits of acceptance of chronic pain indicate that those who are accepting are motivated to engage in life in spite of their pain.

Limitations

One drawback in the design of this study is that pain acceptance and pain catastrophizing were both measured once, at the beginning of the study. Single assessments of these constructs measure what is trait-like or consistent for each individual at that time, but do not allow for exploration of within-person variation of pain acceptance and catastrophizing, nor of how changes in those variables affect other within-person processes. We suspect that there are both trait-like and state-like aspects of pain acceptance. For example, one could have an over-arching tendency to respond to pain with acceptance. Within that broad orientation to be accepting of pain sensations, pain acceptance may fluctuate depending on the moment-to-moment social, physical, and emotional context. These moment-to-moment changes in pain acceptance may also depend on an individual's immediate and long-term goals, and relative

feasibility and likely success of controlling pain. Therefore, measurements at multiple time points, even multiple within-day measurements of pain acceptance, would be optimal.

Though our 10-item measure of pain acceptance demonstrates acceptable levels of validity and reliability and corresponds highly ($r = .77$, $p < .01$) with the original 24-item version of the CPAQ (8), it is not the ideal measure of pain acceptance. To date, McCracken, Vowles, and Eccleston's version of the CPAQ (12) is the only empirically validated measure designed specifically to assess pain acceptance. One of the strengths of this measure is the subscales, Activities Engagement and Pain Willingness, that allow for examination of how various conceptual facets of pain acceptance may impact adaptation differentially. Use of the 20-item CPAQ (12) is recommended as the best widely available measure of pain acceptance and standard use of this measure is necessary for consistency as pain acceptance literature grows.

The assessment of pain and affect on a weekly basis limited this study in a number of ways. First, though preferable to single cross sectional data collection, a weekly assessment method provides a relatively long interval between data collections and limits our ability to draw conclusions about relations between the variables. For example, we can not discern the likely direction of the relation (i.e. causality) between negative affect and pain severity from one week to the next. What the data do indicate, however, is that pain acceptance moderates the relation of changes in worst pain to changes in negative affect within a given week. Also, compared with retrospective estimates of weekly experiences, more frequent assessments of momentary pain and affect would likely yield more reliable values. Nevertheless, prior research has demonstrated acceptable agreement between weekly averages of momentary pain and retrospective recall of weekly pain among chronic pain patients (40). Additionally, when providing retrospective reports of pain people tend to recall the most intense pain (41-43). These findings suggest that this study's participant reports of *worst* pain over the past week are likely to be reliable.

Clinical Implications

We found what is, in absolute terms, a small effect of pain acceptance on the relation of weekly pain and negative affect. To uncover its true significance, however, a small effect must be evaluated in the context of its real world impact (44). In this case, small benefits in mood over a lifetime of managing chronic pain may indeed have a substantial impact on quality of life for pain patients. Pain acceptance may not have a robust one-time effect on well-being. But, for incurable conditions, such as OA and FMS, emphasis should be placed on discovering coping techniques that are enduring and can be flexibly applied to shifting physical and psychosocial challenges.

These findings hold potentially important implications for the treatment of chronic pain patients at a time in psychology when the usefulness of traditional control-based approaches is being questioned. The increasingly popular Acceptance and Commitment Therapy (ACT) proposes that in addressing problematic internal events, like pain sensations and negative emotional reactions, “control is the problem” (45-48). Indeed, experimental data suggest that some common control based strategies to manage acute pain may be detrimental to functioning and adaptation (56-58). Existing psychological treatments for chronic pain, such as mindfulness meditation (49-51) and ACT (52), aim to increase pain patients’ pain acceptance on multiple levels. For example, pain patients who participated in an acceptance-based trial reported decreased levels of distress and increased physical functioning post-treatment and at 3-month follow-up compared to a wait-list control group, and these improvements were mediated by increased levels of pain acceptance as measured by the CPAQ (53). Acceptance-based strategies have also demonstrated benefits in prevention research. An ACT intervention reduced amount of sick leave and medical care use among those at risk for pain-related disability by increasing openness to adverse experiences and reducing the detrimental impact

of pain and stress on participants' valued activities and goals. (54). Thus pain acceptance shows promise as a valuable clinical target among those with chronic pain.

There is a lack of consensus in the field about whether a paradigm shift from control-based to acceptance-based approaches proposed by "third-wave" psychologists and others is warranted (55). Control-based strategies, like those promoted in cognitive-behavioral therapy, are sometimes effective in the alleviating emotional and physical suffering due to chronic pain. However, approaching a recalcitrant problem like chronic pain with control-based strategies alone may leave the chronic pain sufferer vulnerable to frustration, demoralization, and endless preoccupation with reducing pain. The addition of pain acceptance may offer the potential for improved quality of life by filling the often substantial gaps in pain management left by control-based strategies. Pain acceptance, then, is not being proposed as a new model of pain management to replace the old paradigm. Rather, we suggest that the best approach is to integrate pain acceptance with existing pain coping theories to create a more complete theoretical model of coping with pain as researchers have done in other areas (59). It is our hope that our findings and perspectives will contribute to this critical dialog in the field as we explore acceptance-based approaches and question traditional control-based strategies.

The notion of using a combination of both control-based and acceptance-based techniques to bring about an optimal outcome hints that ease in adjusting pain coping goals may become increasingly important as acceptance is incorporated into pain coping models. The very capacity to be flexible in making and pursuing goals in life as well as in management of pain has been shown to be a very important predictor of quality of life. A recent review of personality characteristics and goal adjustment demonstrated that the ability to adjust to and disengage from unattainable goals and to reengage in new and meaningful goals decreases the demoralization of failure and increases quality of life (60). Furthermore, flexibility in modifying pain management goals was found to be more predictive of depression than pain coping, and pain coping was shown to be effective only when pain patients were able to flexibly adjust pain goals (61). It follows that teaching pain acceptance as a complement to traditional pain coping strategies and encouraging the flexible use of both strategies would broaden the pain coping repertoire, leading to improved psychological and functional outcomes as well as increased effectiveness of control-based pain coping strategies. Consistent with this flexible approach to dealing with pain, attempts to control or accept pain are not ends in themselves, but a means of preventing pain from interfering with living the life one desires, regardless of the experience of pain.

Future Directions

The concept of acceptance of chronic pain could potentially be expanded, modified, and applied to other limitations and adversity experienced by chronic pain patients and by those with other chronic illnesses, such as multiple sclerosis, diabetes, and chronic fatigue syndrome. These and other disorders often bring a cluster of symptoms that lead to physical suffering beyond just pain, such as fatigue and muscle weakness, as well as physical limitations, such as loss of mobility or activity restrictions. Intentionally allowing physical discomfort or functional limitation at times when attempting to control such experiences would detract from other goals could be considered an essential skill for adapting to a variety of diseases or disabilities.

To better understand the nature of acceptance of chronic pain and better evaluate its utility, measurement of this construct must improve and better evaluate and reflect the dynamic nature of pain acceptance. Decisions to control or accept pain are likely made on a moment-to-moment basis. Therefore, to capture the influence of pain acceptance in a more ecologically-valid way, measures would need to be taken at multiple points in time. Modern technologies, such as hand-held computers, allow for convenient, reliable, and frequent observations of chronic pain

acceptance and other variables of interest. Advanced analytic techniques, including multilevel modeling, allow for assessment of within-person patterns.

In sum, this study found evidence for a positive impact of pain acceptance on emotions in the context of changes in weekly pain severity. The data hint that positive affect may be an important outcome variable as well as an intermediate factor that influences negative affective outcomes. As evidence for the positive role of pain acceptance mounts, acceptance-based strategies should be considered as potential components of comprehensive psychological interventions for chronic pain.

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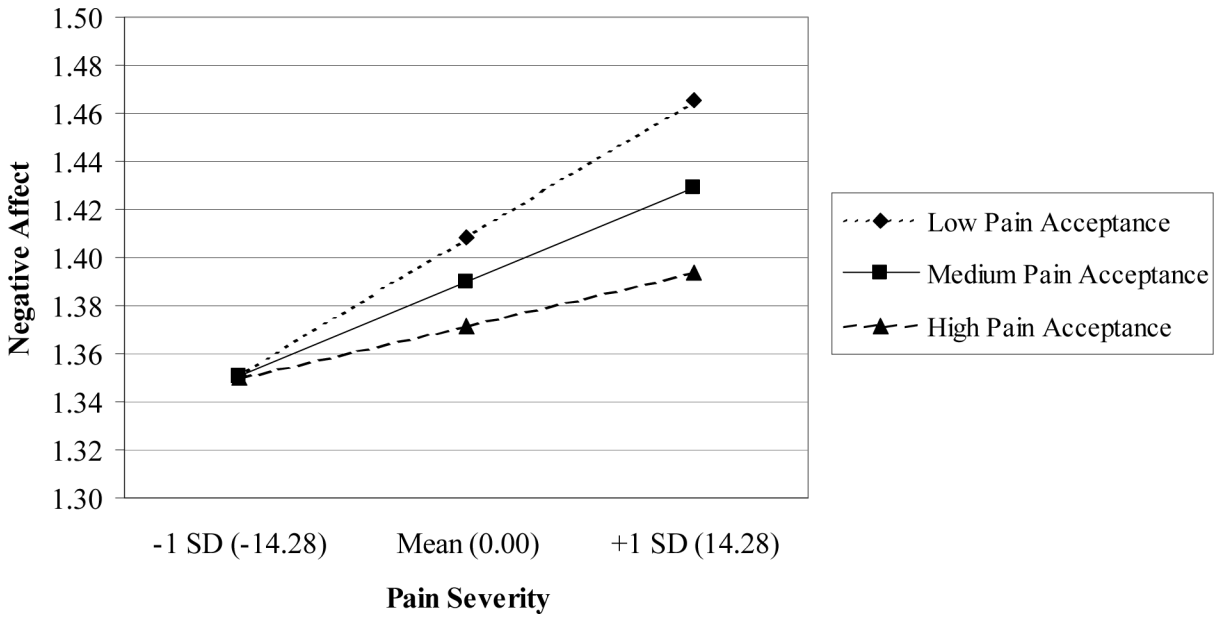

Figure 1.
Interaction of weekly pain severity (person-centered) and pain acceptance (sample-centered) on weekly negative affect (back-transformed from natural logarithm values).

Table 1

Pain acceptance measure instructions, answer scale, and items. *Instructions:* Please read each of the following statements and decide how much you agree with each according to your attitudes, beliefs, and experiences. It is important for you to realize that there are no "right" or "wrong answers to these questions. People are different, and we are interested in how you feel.

Answer Choices:		
1= Strongly Disagree	2=Moderately Disagree	3=Slightly Disagree
4=Slightly Agree	5=Moderately Agree	6=Strongly Agree

1. I am going on with the business of living no matter what my level of pain is.
2. It's okay to experience pain.
3. It's not necessary for me to control my pain in order to handle my life well.
4. I've decided the hassle of trying to get rid of this pain just isn't worth it. I'll live with it.
5. I've done my best to try to control my chronic pain, and it looks like it won't change.
6. Controlling pain is less important than many other goals in my life.
7. I can live with the idea that I will probably have pain for the rest of my life.
8. Despite the pain, I am now sticking to a certain course in my life.
9. I accept the fact that my basic pain level is not going to change in any lasting way.
10. It's a relief to realize that I don't have to change my pain to get on with my life.

Note. The Likert scale was changed from the original CPAQ scale (0 = "Never True" to 6 = "Always true") in order to be consistent with the response scales of other measures in the questionnaire administered to participants.

Table 2

Correlations of key study variables (N = 110)

	1	2	3	4	5
1. Pain Acceptance	-	−.19*	.37**	−.17	−.28*
2. Catastrophizing		-	−.29**	.33**	.26**
3. Positive Affect			-	−.21*	−.28**
4. Negative Affect				-	.23*
5. Worst Pain					-

Note. Positive Affect, Negative Affect (natural log), and Worst Pain represent averaged values over the 8−12 weeks of assessment.

* $p < .05$

** $p < .01$

Table 3

Multilevel Regressions Predicting Weekly Positive Affect

Random Effects					
Covariance Parameter Estimates	Subject	Estimate	Std. Error	Z	p
Intercept	ID	0.234	0.037	6.28	<.01
Worst Pain	ID	0.000	0.000	1.79	.04
AR (1)	ID	0.245	0.038	6.45	<.01
Residual	·	0.221	0.012	18.59	<.01

Fixed Effects					
Predictor Variables	β	Std. Error	df	t	p
Level 1					
Worst Pain*	−0.006	0.001	1020	−5.19	<.01
Negative Affect*	−0.323	0.042	1020	−7.68	<.01
Level 2					
Pain Acceptance†	0.219	0.059	104	3.70	<.01
Within-person Average Worst Pain	−0.004	0.003	104	−1.10	.27
Catastrophizing†	−0.085	0.059	104	−1.44	.15
Age†	0.005	0.007	104	0.65	.52
Level 1 × Level 2					
Pain Acceptance* × Worst Pain*	0.001	0.001	1020	0.89	.37

Note. ID = subject identifier; AR = autoregressive

*Person centered variable

†Sample centered variable

Table 4

Multiple Regressions Predicting Natural Log Transformed Weekly Negative Affect

Random Effects					
Covariance Parameter Estimates	Subject	Estimate	Std. Error	*Z*	*p*
Intercept	ID	0.043	0.007	5.97	<.01
AR (1)	ID	0.221	0.037	5.95	<.01
Residual	·	0.056	0.002	19.72	<.01

Fixed Effects					
Predictor Variables	β	Std. Error	df	*t*	*p*
Level 1					
Worst Pain*	0.003	0.001	1020	5.53	<.01
Positive Affect*	−0.157	0.019	1020	−8.23	<.01
Level 2					
Pain Acceptance†	−0.022	0.025	104	−0.86	.39
Within-person Average Worst Pain	0.002	0.001	104	1.27	.21
Catastrophizing†	0.071	0.025	104	2.89	<.01
Age†	−0.000	0.003	104	−0.05	.96
Level 1 × Level 2					
Pain Acceptance* × Worst Pain*	−0.002	0.001	1020	−2.58	.01

Note. ID = subject identifier; AR = autoregressive

*Person centered variable

†Sample centered variable