The Association of Changes in Pain Acceptance and Headache-Related Disability

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Published online: 5 October 2018

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Abstract

Background Migraine accounts for substantial suffering and disability. Previous studies show cross-sectional associations between higher pain acceptance and lower headache-related disability in individuals with migraine, but none has evaluated this association longitudinally during migraine treatment.

Purpose This study evaluated whether changes in pain acceptance were associated with changes in headache-related disability and migraine characteristics in a randomized controlled trial (Women’s Health and Migraine) that compared effects of behavioral weight loss (BWL) treatment and migraine education (ME) on headache frequency in women with migraine and overweight/obesity.

Methods This was a post hoc analysis of 110 adult women with comorbid migraine and overweight/obesity who

received 16 weeks of either BWL or ME. Linear and non-linear mixed effects modeling methods were used to test for between-group differences in change in pain acceptance, and also to examine the association between change in pain acceptance and change in headache disability.

Results BWL and ME did not differ on improvement in pain acceptance from baseline across post-treatment and follow-up. Improvement in pain acceptance was associated with reduced headache disability, even when controlling for intervention-related improvements in migraine frequency, headache duration, and pain intensity.

Conclusions This study is the first to show that improvements in pain acceptance following two different treatments are associated with greater reductions in headache-related disability, suggesting a potential new target for intervention development.

Clinical Trials information NCT01197196

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Keywords: Migraine • Headache • Pain • Obesity • Acceptance • Disability

Introduction

Migraine accounts for the highest proportion of specific disability worldwide among the neurologic diseases [1]. It is associated with substantial personal suffering [2] as well as significant direct and indirect costs [3]. Novel interventions are therefore needed to reduce disability.

Pain acceptance is reflected in behavior patterns where the individual engages in normal behavior even when pain is present and refrains from the use of avoidance strategies in an attempt to manage pain [4]; and therefore represents an additional target for pain management intervention. As change in pain acceptance predicts reductions in pain disability generally [5], pain acceptance might also improve migraine-related disability.

To date, little research has focused on associations between pain acceptance and migraine. Previous studies show cross-sectional associations of higher pain acceptance with lower pain intensity, headache-related disability, and depression [6–8]. Our group found that higher pain acceptance was associated with less migraine-related disability and decreased pain interference, independent of headache frequency and severity cross-sectionally [9].

Herein, we assess the longitudinal relationship between changes in pain acceptance and changes in headache-related disability in the context of the Women's Health and Migraine (WHAM) trial. WHAM included 110 women with overweight or obesity and also migraine. Participants were randomized to 16 weeks of behavioral weight loss (BWL, $n = 54$) intervention or migraine education (ME, $n = 56$ [10]). Results showed that BWL and ME achieved similar reductions in migraine frequency and severity after treatment that were maintained at follow-up [10]. A previous RCT showed that BWL produced significant positive changes in pain acceptance, with the authors speculating that the amount of behavior change and self-regulation required from BWL may naturally teach a more accepting stance in relation to unwanted or uncomfortable experiences (e.g., hunger, deprivation [11]). Given this, the present study aimed to test the hypotheses that BWL produced greater changes in acceptance from baseline across post-treatment and follow-up time points (as has occurred previously even without explicitly targeting it [11]), and that improvements in pain acceptance were associated with improvements in headache-related disability independent of changes in migraine symptoms.

Methods

Participants were 18–50 years old women with overweight/obesity ($\text{BMI} = 25\text{--}49.9 \text{ kg/m}^2$) and migraine (including ≥ 3 migraine headache attacks and 4–20 migraine headache days during each of the past 3 months). Detailed inclusion and exclusion criteria have been reported previously [10, 12]. All procedures were conducted at the Weight Control and Diabetes Research Center (WCDRC) of The Miriam Hospital between November 2012 and June 2016. Women who responded to advertisements and were determined initially eligible after a telephone screening interview were invited to an in-person orientation at which they completed informed consent, had migraine diagnosis confirmed by a study neurologist, underwent objective height and weight measurement, completed questionnaires, and received a smartphone with a diary application to record headache activity for 28 consecutive days. After the headache monitoring period, participants returned to the WCDRC and received their treatment assignment. Participants were randomized to 16 weeks of BWL or ME in a 1:1 ratio.

Measurement procedures identical to those performed at baseline were repeated at post-treatment (Weeks 16–20) and follow-up (Weeks 32–36). The protocol was approved by The Miriam Hospital Institutional Review Board. The study was registered at ClinicalTrials.gov (NCT01197196).

Interventions

BWL received a standardized lifestyle intervention consisting of 16 weekly group meetings described in detail previously [13]. BWL targeted weight only, not migraine.

ME participants attended 16 weeks of group lectures focused exclusively on migraine (e.g., symptoms and pathophysiology), treatments (e.g., preventive medications and acupuncture), and evidence-based self-management strategies (e.g., relaxation techniques).

Measures

Pain acceptance

The Chronic Pain Acceptance Questionnaire (CPAQ [4, 14, 15]) is comprised of two subscales: (a) activity engagement (performing valued activities despite the presence of pain), and, (b) pain willingness (relinquishing efforts to avoid or control pain), summed to produce a total score. The 20 items are rated on a 7-point scale ranging from 0 (never true) to 6 (always true). The CPAQ demonstrates good internal consistency across a variety of pain syndromes including migraine, and predictive validity (correlations with pain intensity and interference; [4]).

Headache disability

The Headache Impact Test-6 (HIT-6) was used to assess the severity of headache disability [16]. The HIT-6 is a global measure of adverse headache impact containing six items that measure impact on “usual daily activities” including work, school, or social activities; pain severity; fatigue, and desire to lie down; frustration; and difficulty with concentration. Higher HIT-6 scores indicate the greater impact on normal everyday life and ability to function with scores ≤ 49 , 50–55, 56–59, and ≥ 60 indicating little to no impact, some impact, substantial impact, and very severe impact. The HIT-6 has good internal consistency and demonstrates ability to discriminate between different levels of migraine frequency and severity [17, 18].

Migraine headache frequency and pain intensity

Participants recorded headache (yes/no), maximum pain intensity (0 *no pain* to 10 *pain as bad as you can imagine*), and attack duration prior to bedtime for 28 consecutive days via a smartphone-based diary. Responses were

transmitted to the research center and checked to ensure completeness. Missing data were obtained by calls from staff. Data were summarized as headache frequency (number of migraine days/month), average maximum pain intensity, and average headache duration in hours.

Statistical Analysis

Analyses were conducted using IBM SPSS Statistics for Windows, Version 20.0 (IBM Corp., 2011, Armonk, NY: <http://www.spss.com>). Demographics, anthropometrics, headache characteristics, and pain acceptance were summarized using means and standard deviations (SD) or counts with percentages, as appropriate.

To test the hypotheses that BWL produced greater changes in acceptance and that improvements in pain acceptance were associated with improvements in headache-related disability independent of changes in migraine symptoms we used linear and nonlinear mixed modeling methods. The DV in the model was change in pain acceptance. First, unconditional models were used to determine whether a linear or nonlinear trend best fit the longitudinal trajectory of the outcomes (linear was better), and to evaluate the variance components associated with the slope of time to determine assignment as fixed versus random effects (intercepts and slopes were treated as random effects in all models). In a second step, treatment condition (IV) and the interaction between treatment condition and the slope of time were added to the model to account for variability in the trajectory of outcomes. We then added demographic and baseline score covariates to the model. The unit of time was represented as months from baseline. Estimated marginal means for change in pain acceptance by condition were examined at both post-treatment and follow-up. The same approach was used to test for the association between headache disability change (DV) and change in pain acceptance and

headache characteristics (IVs) with condition removed from the model (due to the fact that there were no differences between groups on change in pain acceptance). The analytic approach accommodated missing data by making use of all available data from all randomized participants. All significance tests were two-tailed, with alpha set to .05.

Results

Participant Characteristics

The sample of the 110 participants was entirely female and 86% Caucasian (for more details, see Bond et al. [10]). Additional characteristics are reported in Table 1. Overall retention was 78% ($n = 85$) at post-treatment and 73% ($n = 80$) at follow-up. Means and standard deviations for migraine characteristics, headache disability, and pain acceptance at baseline for all participants are presented in Table 1. As previously reported, there were no differences in medication usage between groups [10].

Between-Group Change in Pain Acceptance

Results of the intent-to-treat mixed effects models analysis showed that mean improvements in pain acceptance did not differ for BWL as compared with ME at both post-treatment (5.51 vs. 5.01, respectively; $F = 0.18$, $p = .664$) and follow-up (5.23 vs. 5.47, respectively; $F = 0.04$, $p = .829$).

Table 1 Means and Standard Deviations for Study Variables

Variable	Baseline	
	<i>M</i>	<i>SD</i>
Age	39.25	7.95
BMI	35.17	6.66
Migraine headache characteristics		
Migraine headache days/month	8.23	4.46
Migraine average duration (hr)	19.87	15.93
Maximum pain intensity (0–10 scale)	5.72	1.58
Headache disability (HIT-6)	64.65	4.46
Pain acceptance (CPAQ)	66.25	15.07

BMI body mass index; *CPAQ* Chronic Pain Acceptance Questionnaire; *HIT-6* Headache Impact Test-6; *SD* standard deviation.

Table 2 Multilevel Model for Changes in Headache Disability (HIT-6) From Baseline Across Post-Treatment and Follow-Up Periods

Variable	Estimate	<i>SE</i>	<i>t</i>	<i>p</i>
Intercept	−43.09	7.20	−5.99	<.001
Time	0.07	0.71	0.10	.917
Covariates				
Race/ethnicity	1.06	0.91	1.17	.248
Age	0.06	0.05	1.12	.264
Baseline HIT-6	0.61	0.11	5.73	<.001
Baseline CPAQ	0.09	0.03	2.70	.008
Baseline MI days	0.04	0.14	0.28	.781
Baseline MI duration	−0.09	0.05	−2.02	.046
Baseline MI pain severity	−0.08	0.36	−0.22	.826
Variables				
CPAQ Δ	−0.12	0.04	−2.78	.006
MI days Δ	0.14	0.12	1.15	.252
MI duration Δ	0.01	0.03	0.49	.629
MI pain severity Δ	0.58	0.20	2.91	.004

CPAQ Chronic Pain Acceptance Questionnaire; *HIT-6* Headache Impact Test-6; *MI* migraine; *SE* standard error.

Association Between Change in Pain Acceptance and Change in Headache Disability

When controlling for baseline levels and change in migraine characteristics, change in CPAQ was significantly associated with change in the HIT-6 measure of headache disability (coefficient = -0.12 , $p = .006$; Table 2). Each additional point on the CPAQ was associated with a reduction of 0.12 on the HIT-6.

Discussion

The current study is the first to examine the association between changes in pain acceptance and changes in headache disability in the context of migraine. The major finding is that positive changes in pain acceptance were associated with reduced headache disability beyond reductions in indices of migraine severity. This suggests that pain acceptance might play an independent role in the functioning of migraine sufferers.

Of note, pain acceptance was not targeted in this study in either treatment condition, however significant positive changes in pain acceptance were observed in both groups. It is possible that the behavioral changes that occur as the result of intervention are significant enough to increase acceptance, even if acceptance-related skills are not taught. One study found that pain acceptance was a strong mechanism of change in cognitive behavioral intervention, even without being directly targeted [19]. Another study found that BWL also produced changes in weight-related acceptance despite not directly targeting acceptance for change [20]. This study extends on those findings by showing that both BWL and an educational intervention can produce positive changes in pain acceptance in a sample of overweight/obese migraine sufferers without directly targeting it. It is somewhat less apparent how an education only condition could produce changes in pain acceptance, however considering the group treatment context it seems plausible that a combination of social support and learning from other group members experiences could account for the change. Another possibility is that both groups experienced substantial reductions in migraine frequency and severity and thus might have found it easier to be accepting of pain that is less frequent and severe. Future research needs to examine these possibilities, and also whether changes in response to acceptance vs non-acceptance-based interventions are similar in magnitude and the degree to which they relate to outcomes to better understand this finding.

Taken together, the current study shows that changes in pain acceptance likely occur naturally as a result of intervention, and that those changes, along with changes in pain intensity, can be helpful for improving functioning. Future research should examine whether explicitly

targeting pain acceptance with acceptance-based interventions produces additional benefits in pain acceptance change and improved functioning for migraine sufferers either by increasing the magnitude of the change in pain acceptance or by increasing the association between change in pain acceptance and reductions in disability.

The current study has notable strengths, including a large sample size, prospectively measured migraine characteristics, and the use of an intent-to-treat approach for analyses. Limitations include a sample that was entirely female, majority Caucasian, and treatment-seeking, and the use of measures that were not migraine-specific measures when assessing pain acceptance and headache disability. It should also be noted that the sample had a relatively high burden for participation and thus was likely highly motivated.

The current study was a post hoc analysis of a randomized trial that showed that pain acceptance contributes to less headache-related disability above and beyond reductions in migraine severity, and thus may be a potential innovative intervention target in the treatment of migraine in conjunction with traditional headache management interventions.

Acknowledgements This study was funded by the National Institute of Neurological Disorders and Stroke (5R01NS077925) and the National Institute of Diabetes, Digestive, and Kidney Disease (1K23DK097143).

Authors' Statement of Conflict of Interest and Adherence to Ethical Standards Jason Lillis, J. Graham Thomas, Richard B. Lipton, Lucille Rathier, Julie Roth, Jelena Pavlovic, Kevin C. O'Leary, and Dale S. Bond declare that they have no conflict of interest.

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