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Changes in Pain Coping, Catastrophizing and Coping Efficacy after Cognitive-Behavioral Therapy in Children and Adolescents with Juvenile Fibromyalgia

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Abstract

A recent randomized multi-site clinical trial found that cognitive-behavioral therapy (CBT) was significantly more effective than fibromyalgia education (FE) in reducing functional disability in adolescents with juvenile fibromyalgia (JFM). The primary objective of this study was to examine the psychological processes of CBT effectiveness by evaluating changes in pain coping, catastrophizing, and coping efficacy and test these changes as mediators of continued improvements in functional disability and depressive symptoms at 6-month follow-up. One hundred adolescents (11–18 years old) with JFM completed the clinical trial. Coping, catastrophizing, and coping efficacy (Pain Coping Questionnaire) and the outcomes of functional disability (Functional Disability Inventory) and depressive symptoms (Children's Depression Inventory) were measured at baseline, post-treatment, and 6-month follow-up. Participants in both conditions showed significant improvement in coping, catastrophizing, and efficacy by the end of the study, but significantly greater improvements were found immediately following treatment for those who received CBT. Treatment gains were maintained at follow-up. Baseline to post-

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treatment changes in coping, catastrophizing, and efficacy were not found to mediate improvements in functional disability or depressive symptoms from post-treatment to follow-up. Future directions for understanding mechanisms of CBT effectiveness in adolescents with chronic pain are discussed.

Keywords

Juvenile Fibromyalgia; cognitive-behavioral therapy; pain coping; catastrophizing; coping efficacy

The effectiveness of cognitive-behavioral therapy (CBT) for children and adolescents with chronic pain has been demonstrated in a number of clinical trials see 7, 14, 26 for a meta-analytic review. These studies found that CBT is associated with improved outcomes in various chronic pediatric pain conditions, including headache, abdominal pain, and fibromyalgia. The common goals of all CBT-based protocols for children and adolescents include improving daily functioning and reducing emotional distress by training youth in the use of active and adaptive coping strategies along with parental guidance to support behavioral changes. Although the evidence base for CBT in the treatment of pediatric pain is quite strong, the underlying psychological processes by which CBT is effective are not well understood. Empirical testing of mechanisms that are expected to lead to improved outcomes and maintenance of treatment effects could lead to further refinement of CBT intervention targets in pediatric pain management and maximize treatment effectiveness.

The rationale for the use of CBT in patients with chronic pain is based on the idea that training patients in specific strategies to cope with and manage pain is associated with improved emotional adjustment and reduced pain-related disability. In addition to enhancing coping, a related goal of CBT is to reduce catastrophic thinking about pain and increase coping efficacy. The use of adaptive coping strategies, lower levels of catastrophic thinking and a greater sense of coping efficacy have all been associated with positive outcomes^{6, 9, 15, 18, 19, 23, 25, 29}. Although these psychological processes are related, the literature suggests that patients' beliefs about pain and the extent to which they catastrophize about pain (considered part of the appraisal process) and how they cope with pain (overt and covert attempts at coping) are independently associated with physical and emotional health outcomes^{17, 33}. When specifically examined in CBT treatment studies, reduction in catastrophic thinking and improvement in pain coping efficacy have been linked to the effectiveness of CBT^{2, 8, 9, 30}. However, the evidence for the effectiveness of specific coping strategies taught during CBT has been less impressive⁵. Thus far, few treatment studies have assessed the effects of CBT on improving pain coping and coping efficacy and decreasing catastrophizing in children with chronic pain. Furthermore, none have assessed how improvements in these psychological processes might mediate the maintenance of CBT treatment effects over time.

In a recent randomized controlled trial of CBT for juvenile fibromyalgia (JFM), we found that adolescents who received CBT intervention showed strong and clinically significant reductions in functional disability and depressive symptoms¹⁴. Interestingly, patients who were randomized to the control condition (fibromyalgia education, FE) also had significant improvements in depressive symptoms and disability. However, CBT led to markedly greater reduction in functional disability at the end of treatment, with continued decreases in disability at 6-month follow-up compared to FE. Small reductions in pain intensity were observed with CBT but the magnitude of improvement was greatest for functional disability and depressive symptoms. The main objective of this secondary analysis of clinical trial

results was to examine the psychological mechanisms of CBT effectiveness by 1) comparing changes in pain coping, coping efficacy and catastrophizing between the CBT and the FE conditions and 2) testing whether changes in coping, efficacy and catastrophizing at post-treatment mediated continued improvement in functional disability and depressive symptoms at follow-up. We hypothesized that adolescents with JFM who received CBT would show greater improvement in coping and coping efficacy, and greater reduction in catastrophizing than the FE group. Further, we hypothesized that improvements in pain coping, catastrophizing and coping efficacy from baseline to post-treatment would mediate CBT outcomes (functional disability and depressive symptoms) from post-treatment to 6-month follow-up.

Materials and Method

Recruitment

Participants were 100 adolescents with JFM who completed the randomized clinical trial. They were recruited from four pediatric rheumatology centers in the US Midwest from December 2005 to December 2009 with treatment and follow-up of all participants completed by June 2010. Children and adolescents aged 11 to 18 years were eligible to participate if they met the following inclusion criteria: 1) met JFM classification criteria based on Yunus and Masi ³⁶ criteria, 2) were on stable medications for 8 weeks, 3) reported average pain intensity 4 on a 0–10 cm Visual Analog Scale based on one week of daily pain diaries, and 4) reported at least mild disruption in daily activities due to JFM symptoms (i.e., score >7 on the Functional Disability Inventory). Children and adolescents were excluded from enrollment if 1) they were diagnosed with any other chronic rheumatic disease, 2) had a documented developmental delay, 3) experienced current symptoms of bipolar disorder, major depressive disorder, panic disorder, or psychosis, or 4) were taking opioid medications.

Institutional Review Board approval was obtained at each site. Parents of the participants provided written informed consent and children and adolescents provided written assent.

Study Procedures

After completing a comprehensive medical and psychosocial baseline assessment which included completing outcome measures and coping questionnaires, eligible patients were randomized to either the CBT or the FE treatment arm. Patients met individually with a trained, doctoral level therapist for 8 treatment sessions in which the interventions were delivered using manualized protocols. CBT sessions focused on explaining the rationale for behavioral strategies in pain management, training in active and adaptive pain coping skills with homework practice of skills, and problem-solving to implement these skills in their daily lives. Skills taught included behavioral strategies such as relaxation and activity pacing, and cognitive strategies such as distraction, problem solving and using positive/calming statements. Parents were included in some of the sessions to teach them how to be effective coaches for their child at home. FE sessions were designed to provide educational information about fibromyalgia and its treatment, general discussion of healthy lifestyles with regard to sleep, diet and physical activity, but no active training or instruction in terms of behavior change. As with the CBT condition, parents were included in the same number of sessions. Sessions were well attended and the study had a high retention rate (88%) without any differential drop out in the two treatment arms. Patients completed all outcome measures and coping questionnaires at the end of 8-weeks of active treatment (post-treatment assessment) and were followed for 6 months with 2 booster sessions spaced 8-weeks apart during the follow-up period. They then completed a final (follow-up) evaluation at the end of 6-months. The principal investigator, study physicians, study coordinator, and

assessment staff remained blinded to the participants' treatment condition throughout the trial. Further details of the study procedure and primary outcomes of the trial were recently published¹⁴.

Measures

The following subset of measures was administered as part of the comprehensive baseline, post-treatment, and follow-up assessments.

The Pain Coping Questionnaire (PCQ)²⁸: is a 39-item self-report questionnaire that assesses pain coping strategies and pain coping efficacy in children and adolescents. The PCQ has demonstrated good internal consistency ($\alpha = 0.79\text{--}0.89$) in samples of children and adolescents²⁸ as well as good content, construct, and concurrent validity²⁷. The measure contains 8 coping subscales including: information seeking (four items, e.g., "find out more information"), problem-solving (six items, e.g., "figure out what I can do about it"), seeking social support (five items, e.g., "talk to someone about how I am feeling"), positive self-statements (five items, e.g., "say to myself, things will be okay"), behavioral distraction (four items, e.g., "do something fun"), cognitive distraction (five items, "put it out of my mind"), externalizing (five items, e.g., "get mad and throw or hit something"), and internalizing/ catastrophizing (five items, "think that the pain will never stop"). Children were asked to rate how much they use a particular strategy in response to being in pain using a 5-point Likert scale. Higher scores indicate greater use of a strategy. To examine "coping", an average composite score of problem solving, positive self-statements, behavioral distraction, and cognitive distraction was created to collectively assess the four pain coping strategies specifically targeted during CBT. Items from each of these subscales were totaled, and an average coping strategies score was computed ranging from 1 to 5. In keeping with prior findings that catastrophizing is distinct from coping and signifies appraisal of the stressor (i.e., pain)³³, the PCQ catastrophizing subscale was examined independently from coping.

Three items on the PCQ assess overall pain coping efficacy, which is one's perceived ability to manage and cope with pain (e.g., "When you are hurt or in pain for a few hours or a few days, how often do you think you can do something to change it?"). Scores on the pain coping efficacy items range from 1 to 5. An average score was calculated ranging from 1 to 5, such that higher scores indicate greater pain coping efficacy. The PCQ coping efficacy scale has been shown to be sensitive to treatment effects in a prior study of adolescents with JFM¹³.

The Functional Disability Inventory (FDI)—The FDI is a well-validated 15-item self-report instrument that assesses children and adolescents' perceived difficulty to perform daily activities in home, school, recreational, and social settings³⁴. The measure was used to assess changes in functional disability outcomes from baseline to post-treatment and follow-up. Participants rated how much difficulty they have performing each of the activities on a 5-point Likert scale (0 = no trouble to 4 = impossible). Total scores on the FDI range from 0 to 60, with higher scores indicating greater disability. For children with chronic pain, the clinical reference points include: 0–12 = No/Minimal disability, 13–29 = Moderate disability, and 30+ = Severe disability¹¹. The FDI has been found to have high internal consistency, moderate to high test-retest reliability, moderate cross-informant (parent-child) reliability, and good predictive validity^{3, 34}.

The Children's Depression Inventory (CDI): was used to assess changes in depressive symptoms from baseline to post-treatment and follow-up. The CDI is a 24-item self-report measure used to assess adolescents' depressive symptoms. It has been well-validated for use in children and adolescents¹⁶. The CDI has strong psychometric properties and is frequently

used in pediatric pain research^{4, 6, 12}. Participants select one of three statements for each item, and total scores range from 0 to 54. In this study, the total raw score was used as an overall indicator of severity of depressive symptoms.

Statistical Analyses

Descriptive statistics were first computed for the coping composite score, catastrophizing, and pain coping efficacy. Correlations between the outcome variables (FDI and CDI), and measures of coping strategies, catastrophizing and efficacy were computed at baseline. Next, the effects of treatment condition were analyzed by examining changes in coping strategies, catastrophizing and efficacy for the CBT and FE groups using a mixed design repeated measures analysis of variance (ANOVA). Treatment group (CBT versus FE) was the fixed factor, and time and group x time interactions were examined for coping strategies, catastrophizing and efficacy. Significant group x time interactions were probed to examine form of growth (linear versus quadratic). Group x time interactions also were graphically displayed to aid interpretation.

For testing whether changes in coping strategies, catastrophizing, and efficacy mediated improvements in functional disability and depressive symptoms, change scores were first calculated. Baseline to post-treatment change scores were computed for coping strategies, catastrophizing, and coping efficacy to represent change over the course of treatment. Changes scores for functional disability and depressive symptoms were calculated from post-treatment to 6-month follow-up to meet the temporal requirement for testing mediation. Positive change scores quantified improvements over time (i.e., increase in coping strategies and efficacy, reduction in catastrophizing, functional disability, and depressive symptoms).

Testing for significant mediation involved testing whether the joint product ($\alpha\beta$) of the regression coefficients relating the independent variable to the mediating variable (e.g., treatment group $\rightarrow$ coping strategies; coefficient α), and the mediating variable to the dependent variable (e.g., coping strategies $\rightarrow$ improvement in functional disability; coefficient β), differed significantly from zero. Two models were conducted for functional disability and depressive symptoms separately. Specifically, 5000 bootstrap samples were analyzed to produce a bias-corrected 95% confidence interval (CI) for possible joint product ($\alpha\beta$) coefficient values based on an empirical sampling distribution³¹. A joint product ($\alpha\beta$) coefficient 95% CI that did not contain zero indicated significant mediation. Furthermore, significant mediation in the presence of a non-significant direct path from treatment group to improvements in functional disability (τ') indicated full mediation, whereas significant mediation in the presence of a significant direct path from treatment group to improvement in functional disability indicated partial mediation²⁰. This particular method of mediation testing was chosen because it is the most robust way to control Type-1 and Type-2 errors (e.g., see^{21, 22}) compared to other methods of mediation testing, such as Baron and Kenny's approach e.g.,¹ that tends to inflate either or both.

Results

Sample characteristics

A total of 114 children and adolescents with JFM were initially enrolled and randomized into the two treatment arms (57 in each arm). Two patients dropped out prior to attending any treatment sessions and an additional 12 patients dropped out during treatment (see¹⁴ for CONSORT flow diagram of the original trial). The final sample of 100 patients (50 in each arm) ranged in age from 11 to 18 years ($M = 15.02$, $SD = 1.75$). A majority of the sample were female (93%) and Caucasian (90%). Parental socioeconomic scores were based upon an index of occupational prestige²⁴. Average scores for mothers ($M = 38.80$, $SD = 23.12$)

represented the equivalent of clerical retail sales occupations and for fathers ($M = 54.68$, $SD = 21.28$) represented the equivalent of lower to mid-level manager positions. A majority of the sample attended regular school (86%), and the remaining were home-schooled (10%), in online/virtual school (2%), or in college (2%) and missed an average of 2.9 days of school per month. Additional sample characteristics are summarized in Table 1. There were no significant differences between participants in the CBT and FE conditions with regard to age, gender, race, socioeconomic status, duration since pain onset, average pain intensity, functional disability, depressive symptoms, school absences, or type of schooling at baseline. The final sample of 100 patients had complete (i.e., no missing values) data for all variables.

Baseline assessment

Individuals in both CBT and FE groups displayed comparable scores on coping strategies, catastrophizing and coping efficacy at baseline. Descriptive data for the coping strategies composite score, catastrophizing, and pain coping efficacy subscales at baseline, post-treatment and follow-up are presented in Table 2. Correlations among all variables at baseline are depicted in Table 3. Higher levels of depressive symptoms were significantly correlated with poorer coping ($r = -0.25$, $p < .05$) and greater catastrophizing ($r = 0.33$, $p < .01$). Higher coping scores were significantly related to lower catastrophizing ($r = -0.25$, $p < .05$) and greater coping efficacy ($r = .53$, $p < .01$). Lastly, lower levels of catastrophic thinking were significantly associated with greater coping efficacy ($r = -0.42$, $p < .01$). None of the measures of coping strategies, catastrophizing or efficacy were significantly associated with functional disability at baseline.

Effects of CBT on Coping Strategies, Catastrophizing and Coping Efficacy

A mixed design repeated measures ANOVA revealed significant main effects for time for the overall sample with improvements in coping strategies, $F(2, 196) = 21.00$, $p < .001$, coping efficacy, $F(2, 196) = 31.86$, $p < 0.001$, and significant reduction in catastrophizing, $F(2, 196) = 23.75$, $p < 0.001$, from baseline to 6-month follow-up (Table 2). Results also demonstrated significant group $\times$ time interactions indicating significantly greater improvement in coping $F(2, 196) = 4.73$, $p = .01$, coping efficacy, $F(2, 196) = 5.16$, $p < 0.01$ as well as reduction in catastrophizing, $F(2, 196) = 6.02$, $p < 0.01$ in adolescents who received CBT compared to those who received FE.

Post-hoc probing of the significant interaction effects revealed significant quadratic growth in the CBT group for coping strategies, $F(1, 98) = 18.73$, $p < .001$, catastrophic thinking, $F(1, 98) = 3.74$, $p < .05$, and coping efficacy, $F(1, 98) = 14.10$, $p < .001$. In contrast, the FE group demonstrated significant linear growth in coping strategies, $F(1, 98) = 10.82$, $p < .01$, catastrophizing, $F(1, 98) = 5.09$, $p < .05$, and pain coping efficacy, $F(1, 98) = 12.44$, $p < .001$ (Figures 1–3). As depicted in Figure 1, there was an immediate increase in the use of pain coping strategies for the CBT group following treatment, which stabilized between post-treatment and follow-up. For catastrophizing, the CBT group demonstrated an immediate decrease in catastrophic thinking following treatment, which continued to decline through follow-up (Figure 2). Lastly, Figure 3 illustrates the CBT group's immediate increase in coping efficacy after treatment and maintenance through follow-up compared to the gradual increase in coping efficacy demonstrated by the FE group. As reported in our primary trial findings, the CBT group also demonstrated expected patterns of improvement in functional disability and depressive symptoms, such that immediate decreases were evident for the CBT group following treatment with continued improvement through follow-up (Figure 4). In contrast, the FE group displayed gradual improvements in disability and depressive symptoms over time.

Mediators of FDI and CDI Improvement

For the direct relationship between treatment group (CBT vs FE) and improvement in outcome from post-treatment to follow-up (functional disability or depressive symptoms), changes in coping strategies, catastrophizing, and coping efficacy from baseline to post-treatment were tested in the same analysis model³⁵. For improvement in functional disability, results showed that the joint product 95% CI for changes in coping strategies ($a\beta = -0.004$; 95% CI = $[-0.06, 0.06]$), catastrophizing ($a\beta = 0.02$; 95% CI = $[-0.04, 0.09]$), and coping efficacy ($a\beta = -0.04$; 95% CI = $[-0.10, 0.03]$) all contained zero indicating no significant mediation. Results also indicated that changes in coping strategies ($a\beta = -0.12$; 95% CI = $[-0.82, 0.46]$), catastrophizing ($a\beta = -0.32$; 95% CI = $[-1.43, 0.19]$), and coping efficacy ($a\beta = -0.24$; 95% CI = $[-1.15, 0.38]$) did not significantly mediate improvement in depressive symptoms.

Discussion

To our knowledge, this is the first study to undertake a longitudinal examination of key psychological processes in a controlled trial of CBT for treatment of chronic pain in a pediatric sample (children and adolescents with JFM). The first objective was to examine whether CBT was associated with significant improvements in coping strategies, reduction in catastrophizing and improved coping efficacy when compared with an attention-control (FE) condition. Consistent with studies in adult fibromyalgia^{2, 8}, this study found that CBT led to significantly improved coping strategies, reduction in catastrophizing and increased pain coping efficacy. Interestingly, the FE group also showed significant improvements in each of these processes over time (i.e., by the 6-month follow-up assessment) even though there was no explicit focus on teaching patients active and adaptive coping skills during FE sessions. The rate of improvement in coping, catastrophizing and efficacy clearly favored CBT, with more rapid improvements by the end of active treatment which were then sustained over time, compared to the FE intervention where the slope of change was more gradual. These findings imply that regardless of treatment condition, therapist attention and support was associated with positive non-specific effects, as demonstrated by significant increases in the use of adaptive pain coping strategies, lower catastrophizing and increased coping efficacy across both treatment groups by the end of the 6-month follow-up. But as noted above, compared to FE, CBT was found to lead to more rapid improvement in coping, reduction in catastrophic thinking about pain, and improved overall pain coping efficacy in adolescents with JFM. Specific components of the CBT protocol that may have contributed to these improvements include teaching multiple adaptive coping strategies, such as relaxation skills, cognitive restructuring, and behavioral distraction, which likely reduced the tendency to magnify negative thoughts about pain and engage in more positive and calming thoughts. Training in coping skills also provided adolescents with active strategies that they could implement in the moment, which likely instilled greater confidence, sense of control, and ability to manage pain. In addition, education about the gate control theory of pain and how pain is processed and perceived by the body, might have served to demystify JFM and “medically unexplained” chronic pain thereby minimizing devastating thoughts and worries related to pain.

Results of this study also provide a better conceptual understanding of the relationship between the psychological processes of coping strategies, catastrophizing and coping efficacy. As might be expected, these three variables were correlated with one another. Additionally, poorer coping and higher catastrophizing were linked to depressive symptoms. In contrast, level of functional disability was not associated with any of the coping variables. This is somewhat unexpected based on the assumption that better coping should be associated with higher levels of functioning but is in keeping with results from some studies of coping in adults with chronic pain⁵. One reason for the poor association between coping

processes and functioning might be that daily functioning in individuals with chronic pain may be more strongly influenced by environmental factors such as school/work and family expectations and support. Alternatively, self-report of coping may be associated with an overall sense of well-being and not necessarily an indication that coping strategies are being effectively used to function better. Future studies should consider using objective measures to complement patients' own report of their coping and function and/or soliciting the perspectives of multiple informants (such as parents) to better understand this relationship.

The second objective of this study was to examine changes in the use of coping strategies, increases in coping efficacy and decreased catastrophizing as potential mechanisms for the effectiveness of CBT in improving functioning and decreasing depressive symptoms. Again, the results were somewhat unexpected as no mediation effect was found for any of the three proposed mechanisms of change. That is, the improvements in coping, decreases in catastrophizing and increases in coping efficacy observed from baseline to post-treatment did not significantly predict improvement in functioning and depressive symptoms from post-treatment to follow-up. The minimal relationship between use of coping strategies and outcomes has been previously reported in the literature⁵, but the non-significant roles for coping efficacy and catastrophizing on treatment outcomes were not anticipated. One potential reason that the mediational models were not statistically significant was that most of the positive change in the proposed mediators (coping, catastrophizing and efficacy) for the CBT group occurred within the active treatment phase (measured by baseline to post-treatment assessments) and this was accompanied by similarly robust improvement in outcomes (functional disability and depressive symptoms) that also occurred over the same time frame. Although the gains in outcome were maintained at follow-up, the magnitude of improvement from post-treatment to follow-up was much smaller. It is conceivable that more frequent assessments may have offered a more sensitive test of mediation than the widely spaced baseline-post-follow-up assessments (9 weeks and 6-months apart) used in the present study.

In addition to the three coping processes examined in this study, the research literature suggests that changes in pain beliefs (which were not measured in this study) may be important to consider as well when examining the effectiveness of psychological therapies. Turner et al.³³ reported that pain beliefs were related to both depression and physical disability in adults, and treatment studies in adults suggest that reducing medically-focused pain beliefs were related to treatment improvement^{9, 10, 32}. Therefore, interventions targeting alteration of specific pain beliefs, such as the belief in pain as an illness or that pain is harmful or disabling, may result in greater patient improvement. Further study of the role of changing pain beliefs in response to CBT interventions in pediatric pain samples is needed.

The current study had several methodological strengths when viewed in the context of the available literature on behavioral treatment for chronic pain, including a relatively large sample size, a rigorously controlled design with an attention control condition, and longitudinal assessments using well-validated measures. The randomized design allowed for the control of positive effects of therapist attention and therapist contact time to examine the specific mechanisms that are unique to CBT, and the sequential assessments allowed for the testing of mediation effects. Limitations of this study were that we focused primarily on adolescent self-reports of coping variables, depressive symptoms and functional disability and that measures were obtained at fairly wide intervals (after completion of the 8-week treatment and then at 6-month follow-up). Additional research also is needed to identify other potential influences not measured in this study, including disease-related factors, child temperament, or family and environmental support. In particular, the role of the family in children's pain coping cannot be understated and should continue to be a focus in pediatric

studies. Given that children with a family history of chronic pain report significantly greater disability and higher levels of catastrophizing¹⁹, contextual cues related to pain coping from the family environment, such as parents' encouragement/discouragement of active coping or hypervigilance to their adolescents' pain experiences, may play a role in children's pain-related disability and either encourage or undermine adaptive coping over time. Future well-powered studies also are warranted to help identify individual baseline characteristics and treatment-related process changes to clarify who positively responds to behavioral treatment.

In summary, findings of this study support the notion that CBT results in significant improvement in pain coping skills, coping efficacy and decreased catastrophizing in children and adolescents with JFM. Some of these improvements can be attributed to the positive, non-specific effects of therapist attention and support. However, changes occur rapidly when patients receive specific training in coping strategies and these changes are maintained over time. This study also highlighted the complexity of understanding the mechanisms of CBT effectiveness. Changes in coping processes were clearly accompanied by improved outcomes with regard to functional disability and decreased depressive symptoms. However, the evidence did not support our expectation that changes in coping, efficacy or catastrophizing would play a mediational role in outcome improvement. Further studies with more frequent assessment time points and with multi-method modes of assessment may help further clarify temporal/causal relationships between the proposed mechanisms of CBT and its' outcomes. Newer technologies such as smartphones or internet-based platforms are making rapid, ecologically-valid, daily or weekly assessments more feasible and may be a useful avenue for better understanding the complex mechanisms underlying psychological changes during treatment. Further studies in this area are needed to develop a more sophisticated conceptual framework for understanding how CBT works in the treatment of chronic pain and enhance our ability to target key psychological processes to have the most positive impact on treatment outcomes.

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Perspective

CBT led to significant improvements in pain coping, catastrophizing, and efficacy which were sustained over time in adolescents with Juvenile Fibromyalgia. Clinicians treating adolescents with JFM should focus on teaching a variety of adaptive coping strategies to help patients simultaneously regain functioning and improve mood.

Figure 1.
Pain coping scores at baseline, post-treatment, and 6-month follow-up.

Figure 2.
Catastrophizing scores at baseline, post-treatment and 6-month follow-up.

Figure 3.
Pain coping efficacy scores at baseline, post-treatment and 6-month follow-up.

Figure 4.
Functional disability (FDI) and depressive symptoms (CDI) at baseline, post-treatment, and 6-month follow-up.

Table 1

Sample characteristics at baseline.

	Total (n = 100)		FE (n = 50)		CBT (n = 50)		p-value
	n	(%)	n	(%)	n	(%)	
Gender							
Female	93	(93.0)	45	(90.0)	48	(96.0)	
Male	7	(7.0)	5	(10.0)	2	(4.0)	0.24
Race							
Caucasian	90	(90.0)	48	(96.0)	42	(84.0)	
African American	6	(6.0)	1	(2.0)	5	(10.0)	
American Indian/Alaskan Native	2	(2.0)	0	(0.0)	2	(4.0)	
Asian	1	(1.0)	1	(2.0)	0	(0.0)	
Biracial	1	(1.0)	0	(0.0)	1	(2.0)	0.13
Type of Schooling							
Regular	86	(86.0)	42	(84.0)	44	(88.0)	
Home-school	10	(10.0)	7	(14.0)	3	(6.0)	
Online/Virtual	2	(2.0)	0	(0.0)	2	(4.0)	
College	2	(2.0)	1	(2.0)	1	(2.0)	0.19
	<i>M</i>	(<i>SD</i>)	<i>M</i>	(<i>SD</i>)	<i>M</i>	(<i>SD</i>)	<i>p</i> -value
Age	15.02	(1.75)	14.88	(1.69)	15.16	(1.81)	0.43
Socio-economic index							
Mother	38.80	(23.12)	40.04	(23.58)	37.55	(22.81)	0.59
Father	54.68	(21.28)	54.52	(23.73)	54.83	(18.97)	0.95
School Absences per Month	2.90	(2.92)	2.67	(2.91)	3.13	(2.94)	0.44
Functional Disability (FDI)	19.82	(8.42)	18.84	(7.83)	20.80	(8.94)	0.25
Depressive Symptoms (CDI)	12.90	(6.13)	12.63	(5.77)	13.16	(6.51)	0.67
Pain Intensity (VAS)	5.72	(1.36)	5.75	(1.39)	5.70	(1.34)	0.87
Pain Duration (in months)	34.23	(29.15)	29.20	(20.80)	39.26	(35.11)	0.08

FDI – Functional Disability Inventory; CDI – Children's Depression Inventory; VAS – Visual Analog Scale

Table 2

Mean (M) and standard deviation (SD) scores on pain coping strategies at baseline, post-treatment, and follow-up.

	FE			CBT			<i>p</i> -value
	Pre-Treatment	Post-Treatment	Follow-up	Pre-Treatment	Post-Treatment	Follow-up	
	<i>M</i> (<i>SD</i>)	<i>M</i> (<i>SD</i>)	<i>M</i> (<i>SD</i>)	<i>M</i> (<i>SD</i>)	<i>M</i> (<i>SD</i>)	<i>M</i> (<i>SD</i>)	
Coping Composite	2.94 (0.68)	3.05 (0.65)	3.21 (0.64)	2.83 (0.61)	3.25 (0.72)	3.19 (0.69)	<.001 *
Catastrophizing †	2.48 (0.99)	2.39 (0.92)	2.22 (0.91)	2.61 (0.94)	2.11 (0.72)	1.89 (0.82)	<.001 *
Coping Efficacy	2.81 (0.60)	2.99 (0.62)	3.13 (0.64)	2.67 (0.62)	3.25 (0.63)	3.28 (0.67)	<.001 *

FE: Fibromyalgia Education; CBT: Cognitive-Behavioral Therapy

Range of possible scores 1–5

† Higher scores are indicative of more maladaptive coping

p-values are based on Repeated Measures ANOVA main effects for pre-treatment to follow-up (Time).

* Additional interaction effect ($p = 0.01$) favoring CBT over FE

Table 3

Correlations among coping, catastrophizing, efficacy, functional disability, and depressive symptoms at baseline.

	Functional Disability	Depressive Symptoms	Coping	Catastrophizing	Coping Efficacy
Functional Disability	--				
Depressive Symptoms	0.23 *	--			
Coping	0.07	-0.25 *	--		
Catastrophizing	0.15	0.33 *	-0.25 *	--	
Coping Efficacy	-0.03	-0.15	0.53 **	-0.42 **	--

* $p < 0.05$;

** $p < 0.01$