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Anger Rumination Mediates Differences Between Fibromyalgia Patients and Healthy Controls on Mental Health and Quality of Life

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Abstract

The present study examined differences between fibromyalgia patients and healthy controls on anger rumination, mental health, and quality of life and tested anger rumination as a mediator of patient-control differences in mental health and quality of life. Participants were a propensity score matched sample of 58 fibromyalgia patients and 58 healthy controls. Participants completed measures of anger rumination, depression and anxiety, and quality of life. Patients were higher than controls on all anger rumination scales and depression and anxiety and lower on quality of life. All anger rumination scales were related to poorer mental health and quality of life. Patient-control differences on mental health and quality of life were mediated by anger rumination. In multiple mediator models, the only subscale with unique mediating effects was anger memories. Anger rumination has potent associations with mental health and quality of life and differences between patients and controls on mental health and quality of life are partially mediated by differences in anger rumination. Addressing tendencies to ruminate on anger experiences in the care of fibromyalgia patients may offer an important avenue to improved health and quality of life.

Keywords: anger rumination, fibromyalgia, mediation, mental health, quality of life

Fibromyalgia (FMS) is one of the most common chronic pain conditions and it affects three to six percent of the world population.[1] Germany (5.8%) and other European countries (4.7%) show similar prevalence estimates.[2] FMS is characterized by widespread muscle pain, fatigue, and tender points.[3] These symptoms are known to be disruptive for sleep and cognitive functioning (i.e., "fibro fog"),[4-6] and can also exacerbate pain and interfere with daily functioning and quality of life.[7, 8] This vicious cycle of symptom interference and exacerbation can negatively impact psychological and physical well-being,[9] as evidenced by higher rates of anxiety and depression,[7, 8, 10-12] and lower levels of quality of life,[7, 8, 13, 14] in people with FMS compared to the general population.

Several cognitive and affective factors have been identified as contributing to poor physical and mental quality of life of people with FMS. Of interest in the present study is anger rumination which is a particular form of anger expression that involves perseverative thoughts about experiences of anger that arise during and after the experience of this negative emotion.[15, 16] Rumination over an anger episode can trigger past memories of other anger experiences, which in turn increases both the intensity and duration of the experience of anger, and exacerbates its consequences.[17] Accordingly, anger rumination has been conceptualized as being comprised of four different cognitive processes including: a) anger afterthoughts (thoughts that maintain anger and re-enact the anger episode mentally), b) anger memories (dwelling on the injustices experienced in the past), c) fantasies about revenge (imagining how to get back at the transgressor), and d) trying to understand causes (generating counterfactual thoughts about the causes of the anger-provoking event and why it occurred).[15] However, as a process, anger rumination arises from the cyclic and mutually reinforcing interaction of each of these dimensions making it important to also consider the global construct (i.e., total score) when assessing the effects of anger rumination.[15]

Higher levels of negative emotions, such as anger and anger rumination, have been

found among individuals with FMS compared to healthy controls.[18-20] There are several reasons to expect anger to be elevated in FMS patients. FMS patients, like many chronic pain patients, may be angry at several individuals and systems. For instance, they may be angry with doctors or mental health providers for not providing more effective care. They may be angry with the insurance or legal system for not providing adequate coverage or protections. FMS patients may be angry at themselves for not coping effectively with their condition, their spouses or families for not offering adequate support, or employers for not providing suitable working conditions or accomodations. Finally, FMS patients may be angry with God or the whole world for the challenges they face in life.[21] Anger is an appropriate response to perceived injustice.[22] Individuals with FMS are often disadvantaged and anger eliciting experiences are more prevalent and intense and this protracted anger is an important contributor to impairments in mental health and quality of life.[22] Further, as the frequency and intensity of anger experiences increases, one's relationships with friends and family may be strained resulting in reduced social support. As social support is vital to good mental health, anger may indirectly contribute to poorer mental health and quality of life through social isolation.[23]

When anger and rumination are combined and experienced as anger rumination the effects can take a substantial toll on mental and physical well-being[24] To our knowledge, the only theory to specifically address the unique and detrimental effects of anger rumination on mental and physical well-being is the *Multiple Systems Model of Angry Rumination,* developed by Denson in 2012.[16] The *Multiple Systems Model of Angry Rumination* states that at the affective level angry rumination functions to sustain the emotional experience of anger, in fact, increasing the experience of anger over time.[16] In so doing, anger rumination may prolong the effects of momentary anger-eliciting situations[16, 17] and magnifiy the impact of anger on mental health and quality of life. The *Multiple Systems Model of Angry Rumination*

aslo states that at the cognitive, neuro-hormonal, and cardiovascular levels, anger rumination is thought to elicit changes in functioning that are commonly involved in stress and negative affect.[16] For instance, self-focused rumination on anger can elicit negative affect[16]; anger rumination invokes many areas of the brain such as the anterior cingulate cortex, insula, hippocampus, and amygdala [25, 26] that are also active in depression[27]; and anger rumination shows cardiovascular ramifications similar to those of depression.[28]

Although depressive rumination is commonly known to be associated with mental and physical well being,[29, 30] not surprisingly anger rumination has also shown important associations with a number of mental health outcomes including: boderline personality symptoms,[31] anger,[17] negative emotion,[31] binge-eating and alcohol use,[32] and anxiety and depression.[33, 34] The magnitude of associations between anger rumination and mental health is often somewhat smaller than those between depressive rumination and mental health, but they are still meaningful (*r*s ≈ .3 - .5) and significant. For example, in one study anger rumination was slightly *more* strongly correlated with depression than even depressive rumination.[31] In another study anger rumination was at least as, if not slightly more, strongly related to depression and anxiety than to aggression.[34] Clearly, anger rumination is of considerable relevance to mental health and thus warrants further investigation.

Of particular importance for the present purposes are two studies. In one study, anger rumination was examined as a mediator of the well-known anger-depression association.[35] This was a study of 88 individuals with major depressive disorder, and results showed that anger rumination mediated the associations between multiple forms of anger and hostility with depression. Similarly, in a second study of a sample of 449 Tehran undergraduates, anger rumination was again found to be a mediator of the association between anger and mental health.[36] These mediation models provide the basis of the conceptual model and logic for the present study. That is, because anger rumination mediates associations of anger and

depression and individuals with FMS show higher levels of anger than healthy controls, it follows that anger rumination might account for differences between individuals with FMS and healthy controls on mental health outcomes. To date, there is only one small study [20] investigating differences in levels of anger rumination in individuals with FMS in comparison to healthy controls, but the degree to which these differences in anger rumination helped explain decrements in health and quality of life in individuals with FMS was not explored.

The Present Study

Considering current theory and evidence, the present study investigated the extent to which anger rumination explains differences between FMS patients and healthy controls on mental health and quality of life outcomes. Consistent with the extant literature,[7, 8, 10, 37] it was expected that FMS patients would show higher levels of depression and anxiety symptoms and lower levels of mental health-related and overall quality of life. It was also expected that FMS patients would show higher levels of anger rumination as compared to controls, as research has noted that FMS patients have elevated levels of anger, rumination, and anger rumination compared to healthy individuals.[18-20, 38] These higher levels of anger rumination were expected to explain the differences (i.e., mediate) between FMS patients and controls on mental health and quality of life outcomes. We also examined the individual anger rumination subscale scores expecting that, consistent with existing research, anger afterthoughts and anger memories would be the most important mediators as these aspects of anger rumination would be most likely to prolong and heighten anger experiences, and as a result, connect more strongly to mental health and quality of life.[33, 34]

Method

Participants and Procedures

With the support of the German Fibromyalgia Patient Association, fibromyalgia patients were recruited from several self-help groups. Group leaders were contacted by an

author (MO) and were sent the patient materials including an information letter regarding the study objectives, the questionnaires, and a consent form. Group leaders were asked to distribute the materials and to collect and return them when completed. The only inclusion criterion for FMS patients was the diagnosis of FMS. Healthy controls were recruited by research assistants and were a convenience sample of German individuals without FMS from the general population. Research assistants approached members of their social networks and invited them to participate. There were no additional inclusion/exclusion criteria for healthy controls. FMS patients (n = 173) were over-enrolled in comparison to healthy controls (n = 81) in the study. This was done to offer sufficient sample size to conduct sub-group analyses that are outside the scope of the present study. For the present purposes, the 254 participants were matched using propensity score matching (PSM). PSM yielded a matched sample of 58 FMS patients and 58 healthy controls with no differences on age, gender, and marital status. Differences in education that existed in the full sample of 254 participants remained present in the PSM sample (see Analyses section for further details). Ethics committee approval was obtained from XXX (redacted for blind review), and all participants provided informed consent.

Measures

Anger rumination. The Anger Rumination Scale is a 19-item scale developed to assess the tendency to focus on anger afterthoughts, thoughts of revenge, anger memories, and the causes and consequences of anger.[15] The Anger Rumination Scale has acceptable internal (α = .93) and one-month test-retest (r = .77) reliability and factorial and convergent/discriminant validity (rs = .37 -.57) with state-trait anger, life satisfaction, and social desirability and has been translated and cross-culturally validated in several countries.[15, 39-42] A German translation was developed for this study where the primary translation was performed by two bilingual researchers familiar with the topic related to the

questionnaire. It was then translated back into English again by two different bilingual persons who had no prior knowledge of the instrument. The procedure was conducted according to published guidelines.[43] An example anger afterthoughts item is, "I re-enact the anger episode in my mind after it has happened." An example thoughts of revenge item is, "I have long living fantasies of revenge after the conflict is over." An example, anger memories item is, "I think about certain events from a long time ago and they still make me angry." An example causes and consequences of anger item is, "I analyze events that make me angry." Responses are provided on a Likert scale ranging from 1 (*almost never*) to 4 (*almost always*). The total score can range from 19 to 76 and higher scores indicate higher anger rumination. In the present study, coefficient alpha for patients and controls, respectively, was .94 and .88 for the total score, .89 and .74 for anger afterthoughts, .63 and .62 for thoughts of revenge, .88 and .70 for anger memories, and .78 and .74 for causes and consequences of anger.

Anxiety and depression. The Hospital Anxiety and Depression Scale is a 14-item self-report questionnaire measuring symptoms of anxiety and depression.[44] It was developed for use in general medical out-patient clinics but is now widely used in research in clinical practice and the general population.[45] The Hospital Anxiety and Depression Scale has good reliability and construct validity.[46] The German version of the Hospital Anxiety and Depression Scale was used in this study and it has been shown to have acceptable reliability (anxiety $\alpha = .80$, depression $\alpha = .81$).[47] An example anxiety item is, "I get a sort of frightened feeling like 'butterflies' in the stomach," and an example depression item is, "I still enjoy the things I used to enjoy." Responses are based on the relative frequency of symptoms over the past week, using a four point Likert scale ranging from 0 (not at all) to 3 (very often). The total score for each of the depression and anxiety scales can range from 0 to 21 and higher scores indicate higher depression and anxiety. In the present study, coefficient alpha for anxiety for patients and controls was .86 and .76, respectively. Coefficient alpha for

depression for patients and controls in the present study was .82 and .81, respectively.

Quality of life. The Quality of Life Scale is a 16-item questionnaire designed for use in the general population [48] and also in chronic disease patients including patients with FMS.[49] Items assess various aspects of quality of life such as physical and material well-being, relationships with other people, social, community, and civic activities, personal development and fulfillment, recreation, and independence. The German version of the Quality of Life Scale was used and it has shown acceptable internal consistency (α = .90), test-retest reliability (r_s = .91), and convergent validity (rs = .37 - .58) with fibromyalgia symptoms and health-related quality of life and divergent validity (rs = .11 - .20) with pain.[50] The average score for the Quality of Life Scale in a sample of 146 FMS patients was 72.03 (*SD* = 16.03).[50] An example item is, "How satisfied are you with material comforts home, food, conveniences, and financial security?" The items are scaled from 1 to 7 and aggregated into a sum score where a higher score indicates higher quality of life. The total score can range from 16-112. In the present study, coefficient alpha for patients and controls was .91 and .91, respectively.

Mental health-related quality of life. The MOS Short Form 12, commonly known as the Short Form-12, is a multidimensional general measurement instrument assessing health-related quality of life. It has become widely used in clinical trials and as a standard outcome assessment instrument because of its brevity and psychometric performance.[51] The German version of the Short Form-12 was used.[52] The original two-dimensional structure of the English Short Form-12 has been replicated in a German sample of diabetes mellitus patients and the German general population using the German Short Form-12.[53, 54] Strong correlations (r = .96) between Short Form-12 and Short Form-36 measures have been reported in a German cardiac sample and in this same sample the average score on the mental health-related quality of life scale was 47 (*SD* = 11).[55] The mental health composite score was

used in this study, which has scores ranging from 0 to 100, with higher scores indicating better mental health-related quality of life. An example mental health item is, "Have you felt downhearted and blue?" The mental health composite score has shown test-retest reliability coefficients of .76 and greater.[56] In the present study, coefficient alpha for patients and controls was .78 and .74, respectively.

Socio-demographics. Age and sex were assessed, as were educational level (i.e., 9 or less years, 10-11 years, 12 or more years, advanced) and marital status (i.e., married versus other).

Analyses

Propensity score matching (PSM) was used to match the FMS patient sample to the healthy control sample. PSM involves deriving a propensity score from logistic regression analysis that is then used to match samples. SPSS uses a "fuzzy matching" algorithm to match propensity scores. Even with the strictest of requirements for matching, some pre-existing differences could not be eliminated. As such, we used a strict matching requirement (.1, range 0 – 1) which offered reasonably sized samples that were matched on three of four demographic variables. Sample differences in education persisted in the PSM sample. It is worth noting that results from the full sample and the PSM sample were virtually identical.

Descriptive statistics and bivariate correlations between all study variables are provided. Hypothesis one and two suggested that FMS patients would have poorer mental health and quality of life and higher levels of anger rumination. These hypotheses were examined by using independent t-tests to test the statistical difference between FMS patients and healthy controls on these variables. Cohen's d was used as the measure of effect size. A dummy variable was created and coded "1" for fibromyalgia patients and "0" for healthy controls. Use of this variable in regression analyses allowed for the comparison of patient-control differences in anger rumination and mental health and quality of life outcomes.

Hypothesis three predicted that differences between FMS patients and healthy controls on anger rumination would explain differences on mental health and quality of life. The PROCESS macro for SPSS was used to examine this hypothesis. PROCESS allows for explicit testing of direct and indirect (i.e., mediating) effects using bootstrapping estimation techniques that have been shown to outperform traditional sequential modeling methods and the Sobel test.[57] PROCESS also offers the ability to test multiple simultaneous mediators. That is, PROCESS provides analyses that clearly indicate the direct effect of the patient-control variable (predictor) on mental health and quality of life (outcomes) and test the degree to which patient-control differences exert an effect on mental health through differences in anger rumination (mediator). Models were run examining the mediating role of anger rumination total scores on patient-control differences in mental health and quality of life. Models were also run examining the mediating role of anger afterthoughts, revenge, anger memories, and understanding of causes subscales of the anger rumination scale as multiple simultaneous mediators of the patient-control differences in mental health and quality of life. Our PSM samples showed statistically different levels of education and small variations in age, sex, and marital status, and as such, all mediation models controlled the effects of age, sex, marital status, and education. Examination of model residual plots and skew statistics (< 2) indicated that no variables were notably skewed and models adhered to assumptions of normality. Statistical significance was set at $p < .05$ for two-tailed tests.

Results

Table 2 shows the descriptive statistics for anger rumination, mental health, and quality of life for both FMS patients and healthy controls. As hypothesized, overall anger rumination was higher in FMS patients than in healthy controls. Differences were largest for anger memories ($d = .84$), and anger afterthoughts ($d = .68$). A moderate-sized difference ($d = .57$) between FMS patients and healthy controls was found for understanding of cause, and

the smallest difference was observed for thoughts of revenge (d = .40). Also as hypothesized, differences were observed between FMS patients and healthy controls on anxiety, depression, quality of life, and mental health-related quality of life. These differences were all large in size ($d \geq 1.31$).

Table 3 shows the total sample descriptive statistics and bivariate correlations for all study variables. Anger rumination and all sub-dimensions of anger rumination were positively related to anxiety and depression and negatively related to quality of life and mental health-related quality of life. All associations were of medium to large magnitude (|rs| = .29 - .63). Anger rumination sub-dimensions were inter-correlated (|rs| = .53 - .77) as were the mental health and quality of life variables (|rs| = .60 - .79).

Hypothesis three predicted that anger rumination would mediate some part of the differences between FMS patients and healthy controls on mental health and quality of life outcomes. Figure 1 shows the path model results from testing the mediating effects of total anger rumination. The anger rumination total score mediated the differences between FMS patients and healthy controls on every mental health and quality of life outcome variable. Anger rumination mediated 24, 19, 15, and 17 percent of the patient-control differences and indirect effects (B) were 1.22, 1.16, -3.42, and -2.41, and were all statistically significant ($p <$ .05), for anxiety, depression, quality of life, and mental health-related quality of life, respectively.

To determine if anger afterthoughts and anger memories were indeed the most important mediators in understanding patient-control differences in mental health and quality of life, each of the four subscales of the anger rumination scale were used as mediators in simultaneous multiple mediation models. Figure 2 shows the path model results from testing the simultaneous mediating effects of anger rumination subscales. As before, the four anger rumination subscales mediated patient-control differences on mental health and quality of life

outcomes accounting for 30, 23, 19, and 18 percent of the patient-control differences on anxiety, depression, quality of life, and mental health-related quality of life, respectively. Interestingly, significant indirect effects were only consistently present for the anger memories subscale because other subscales were either not related to the outcomes or were related at smaller magnitudes. Individual indirect effects for anger memories as the mediator were 1.22, 1.52, and -5.13 for anxiety, depression, and quality of life (ps < .05), and -1.94 (n.s.) for mental health-related quality of life.

Discussion

This is the first study, to our knowledge, to examine anger rumination in FMS patients relative to healthy controls, and to further test the mediating role of anger rumination in accounting for mental health and quality of life differences between FMS patients and healthy controls. The current results mostly confirm our hypotheses and are consistent with previous work showing higher levels of anger, rumination, and anger rumination in individuals with FMS compared to controls.[7, 8, 18-20, 38] The present findings also align with research showing the harmful associations of anger rumination with mental health and quality of life.[24, 33, 34] Also confirming our hypotheses, the total anger rumination score explained a significant proportion of the patient-control differences in mental health and quality of life outcomes. In multiple mediator models anger memories (dwelling on past anger-provoking events and injustices) proved to be the only sub-dimension of anger rumination to play and explanatory role, partially confirming our expectation. Engaging in afterthoughts about anger-provoking events that maintain anger, having fantasies about revenge toward the transgressor involved in the anger event, and trying to counterfactually understand the causes of the anger-provoking event, did not uniquely explain the deficits in health and quality of life experienced by the FMS patients in our sample compared to the control group.

As these are the first known data to show that anger rumination may in part explain why FMS patients show poorer mental health and quality of life compared to healthy controls we consider some explanations that may prompt useful research questions for future work. It may be worth considering the source of FMS patients' anger. Although anger targets were not measured in the current study, one might speculate that given the widespread pain, functional limitations, and unclear etiology of FMS, patients may have been ruminating about the unfairness of having their condition and blame or be angry at themselves or others for not being able to manage better. One study of the anger targets of people with chronic pain supports this hypothesis. Of 96 patients surveyed, 70 percent indicated that they experienced anger, and listed themselves (74%) and health care professionals (62%) as the two most frequent anger targets.[58] If FMS patients similarly target themselves and health care professionals as the main sources of their anger, then how patients cope with their anger is important to understand. Immediate anger afterthoughts, revenge, and counterfactuals may not apply when the source of anger is oneself or one's healthcare professional. For instance, immediate afterthoughts are fleeting and may not have much long-term effect, and taking revenge on oneself or one's doctor, or thinking about how things might have been different (i.e., counterfactuals), may simply be irrelevant as there are no straightforward means of exacting revenge or creating a different outcome. Instead, it may be the frequency or intensity of memories of the anger-inducing event, or of reliving the anger-evoking experience, that creates distress and associated mental health and quality of life decline. Furthermore, the items on the anger memories subscale reference long-term issues with anger and it may be the chronicity of anger rumination that is particularly important.

Research supports these assertions. First, self-blame has been found to compromise the mental well-being of individuals with chronic health conditions,[59] suggesting that rumination on self-blame and the resulting anger may be especially detrimental for FMS

patients. Second, chronic pain patients commonly feel angry at themselves and others.[60, 61] Third, chronic anger aggravates the mental and physical symptoms associated with chronic pain and illness.[62-64] Nonetheless, further research that includes an assessment of the anger targets that FMS patients may ruminate on would provide confirmation of these propositions.

Anger expression can be healthy when it instigates instrumental action.[65, 66] However, when the expression of anger becomes ruminative, it can be quite harmful to the health and quality of life for people with FMS.[19, 67] Treatments that target rumination may therefore be useful for reducing the toll of anger rumination on the mental health and quality of life of FMS patients, and interventions that focus on patients, caregivers, and healthcare providers as the source of anger may be especially effective. One intervention option might be to consider Rumination-Focused Cognitive Behavioral Therapy (RFCBT).[68] The theory and research behind RFCBT show that two forms of rumination exist—unconstructive and constructive.[69] Anger rumination is unconstructive rumination in that the emotional valence and intrapersonal context are both negative. Conversely, simple reflection offers an example of constructive rumination where both emotional valence and intrapersonal context are positive. The intervention is designed to help individuals recognize and shift from unconstructive rumination to constructive rumination. Doing so might involve identifying warning signs of unconstructive ruminative behaviors, learning counter-ruminative behaviors (e.g., distraction), and developing action plans for interruption of unconstructive and promotion of constructive rumination. RFCBT has been shown to be effective [68] and could be useful for FMS patients experiencing anger rumination.

Another option is to consider forgiveness interventions. Because anger rumination is related to low levels of forgiveness [24] and self-blame has been linked to low self-forgiveness, [70, 71] interventions that promote forgiveness may be particularly useful in helping control anger rumination in FMS patients. Forgiveness of others and self-forgiveness interventions

have been developed [71, 72] and have been shown to be efficacious and been well-received in FMS patients.[73, 74] At the core of anger rumination is the notion of injustice and as forgiveness is a powerful method of reducing feelings of injustice, it might well address the root cause of anger rumination.

A final option to consider might be metacognitive therapy.[75] According to this approach, positive beliefs about rumination motivate individuals to engage in sustained repetitive thought, but once rumination commences individuals recognize that the process is uncontrollable and detrimental to one's mental health and well-being.[76] Individuals then develop concerns about these repetitive thought processes and return to favorable beliefs about rumination as a means of effective coping. In the case of anger rumination individuals may initially see mulling over anger memories as an appropriate response to resolving an injustice, but as anger experiences are prolonged and heightened through this repetitive process it will likely prove an ineffective coping strategy. Intervention targets may be to enhance metacognitive control, reframe positive and negative beliefs about rumination, and increase cognitive flexibility.[76]

The present findings, though novel, should be considered in the context of several limitations. First, the cross-sectional nature of this study precludes causal conclusions about the extent to which anger rumination acts to cause differences in mental health and quality of life. Issues of causality will be important to address in future work which could involve experimental designs and models incorporating competing mediators and outcomes simultaneously. For instance, other specific possible explanatory variables such as depressive rumination should be considered in future studies to determine if it or other unmeasured constructs might explain the present mediation findings. Nevertheless, it is useful to know that patient-control differences in mental health and quality of life are, in some part, accounted for by differences in anger rumination, which might be targeted via therapeutic

interventions to improve the impaired mental health and quality of life of FMS patients. Second, the study used a convenience sample of patients and healthy controls, the former of which was recruited from a patient self-help group in only one region of the world, and therefore the applicability of the findings to broader, more representative samples of patients and controls is limited. Third, data was collected via self-reports making response bias (i.e., faking good or bad) and shared method variance reasonable concerns. Fourth, internal consistency of the thoughts of revenge subscale of anger rumination was low which may have attenuated associations with health and quality of life outcomes. Fifth, we did not collect co-morbid illnesses, diseases, medications, or other clinical data. Sixth, because patient support groups met at various locations at too great a distance for the authors to travel, the administration of the assessments may have occurred under differing circumstances for FMS patients and healthy controls.

Conclusions

FMS patients face a host of challenges that can result in anger at oneself or others and when this anger turns to anger rumination the experience can live on chronically for the patient. To our understanding, this is the first study to examine the associations of anger rumination with mental health and quality of life outcomes in FMS patients and healthy controls. FMS patients showed higher levels of anger rumination and poorer mental health and quality of life, as compared to healthy controls. Anger rumination explained statistically significant portions of patient-control differences in mental health and quality of life and the key explanatory mechanism was anger memories, suggesting that anger memories fuel symptom elevation in mental health and lower quality of life in FMS patients. The nature of anger memories, as measured using the current index, suggests that the chronic burden of reliving or rethinking old experiences of anger are the key unhealthy mechanism for FMS patients. Interventions aimed at reducing rumination, of any kind, or addressing the core

cause of anger—a previously experienced and unforgiven injustice—may offer relief from the weight of ruminative processes that are associated with poorer outcomes for FMS patients.

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Table 1.

Socio-Demographic Descriptive Statistics for Fibromyalgia Patients and Controls in Full and Matched Samples

	Full Sample					Matched Sample				
	Patients	Controls	t/χ^2	*p*	*d*/*r*	Patients	Controls	t/χ^2	*p*	*d*/*r*
Age in years[1]	58 (8.8)	47 (14.2)	57.76	<.001	.42	54 (9.1)	52 (8.9)	-.98	.330	.18
Gender (female/male)[2]	161/9 (95/5)	76/5 (94/6)	.08	.777	-.02	53/5 (91/9)	53/5 (91/9)	.00	1.00	.00
Marital status[2]			.02	.887	-.01			.198	.656	-.04
Married/with partner	130 (76)	59 (76)				44 (76)	46 (79)			
Single/widowed/divorced	40 (24)	19 (24)				14 (24)	12 (21)			
Education (years)[2]			68.76	<.001	.41			12.46	.006	.33
9 or less	74 (44)	7 (9)				13 (22)	6 (10)			
10 or 11	65 (39)	23 (29)				25 (43)	20 (35)			
12 or more	16 (10)	44 (56)				12 (21)	29 (50)			
Advanced	12 (7)	5 (6)				8 (14)	3 (5)			

[1]*M* (*SD*), t test;

[2]*n* (% within column), χ^2 test

Table 2.

Average Levels of Main Study Variables for Fibromyalgia Patients and Controls

	Patients		Controls				
Variable	*M*	*SD*	*M*	*SD*	*t*	*p*	*d*
Anger Rumination (ARS)	42.60	13.42	34.18	8.62	4.02	< .001	.75
Anger Afterthoughts (ARS-AA)	14.33	5.19	11.33	3.55	3.63	< .001	.68
Thoughts of Revenge (ARS-TR)	6.45	2.26	5.64	1.82	2.13	.04	.40
Anger Memories (ARS-AM)	11.75	4.45	8.71	2.66	4.46	< .001	.84
Understanding of Causes (ARS-UC)	10.11	3.14	8.48	2.64	3.02	.003	.57
Anxiety (HADS-A)	10.26	4.70	5.10	3.05	7.01	< .001	1.31
Depression (HADS-D)	9.10	4.39	2.95	2.47	9.30	< .001	1.74
Quality of Life (QOLS)	65.79	14.31	88.48	14.31	-7.08	< .001	1.33
Mental Health-Related Quality of Life (SF-12)	37.45	10.53	50.78	8.56	-6.89	< .001	1.40

Table 3

Descriptive Statistics and Bivariate Correlations for all Study Variables

	M	*SD*	1	*p*	2	*p*	2.1	*p*	2.2	*p*	2.3	*p*	2.4	*p*	3	*p*	4	*p*	5	*p*
1. Patients vs. Controls	0.50	0.50	--																	
2. Anger Rumination	38.39	12.00	.35	<.001	--															
2.1. Anger Afterthoughts	12.83	4.68	.32	<.001	.93	<.001	--													
2.2. Thoughts of Revenge	6.04	2.08	.20	.036	.73	<.001	.63	<.001	--											
2.3. Anger Memories	10.23	3.96	.39	<.001	.88	<.001	.72	<.001	.55	<.001	--									
2.4. Understanding of Causes	9.30	3.00	.27	.003	.88	<.001	.77	<.001	.53	<.001	.73	<.001	--							
3. Anxiety	7.68	4.72	.55	<.001	.55	<.001	.49	<.001	.32	<.001	.58	<.001	.44	<.001	--					
4. Depression	6.02	4.70	.66	<.001	.57	<.001	.47	<.001	.39	<.001	.63	<.001	.44	<.001	.74	<.001	--			
5. Quality of Life	77.04	20.57	-.55	<.001	-.42	<.001	-.36	<.001	-.30	.001	-.47	<.001	-.29	<.002	-.60	<.001	-.79	<.001	--	
6. Mental Health-Related Quality of Life	43.91	11.68	-.57	<.001	-.48	<.001	-.42	<.001	-.30	.002	-.50	<.001	-.42	<.001	-.72	<.001	-.74	<.001	.62	<.001

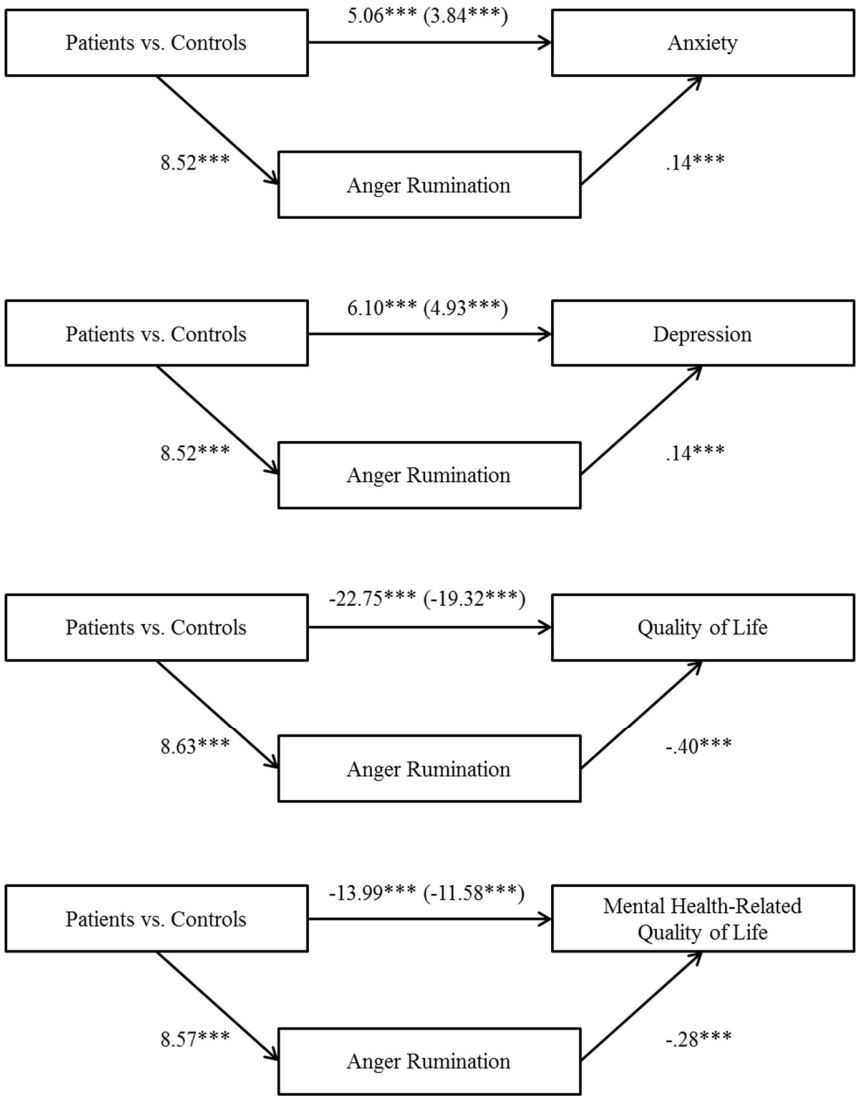

Figure 1. Patient versus control differences in mental health and quality of life outcomes are mediated by anger rumination. Total effects and direct effects (in parentheses) are included for patient-control differences on each outcome. All models control for the effects of age, gender, marital status, and education (not shown). *** $p < .001$.

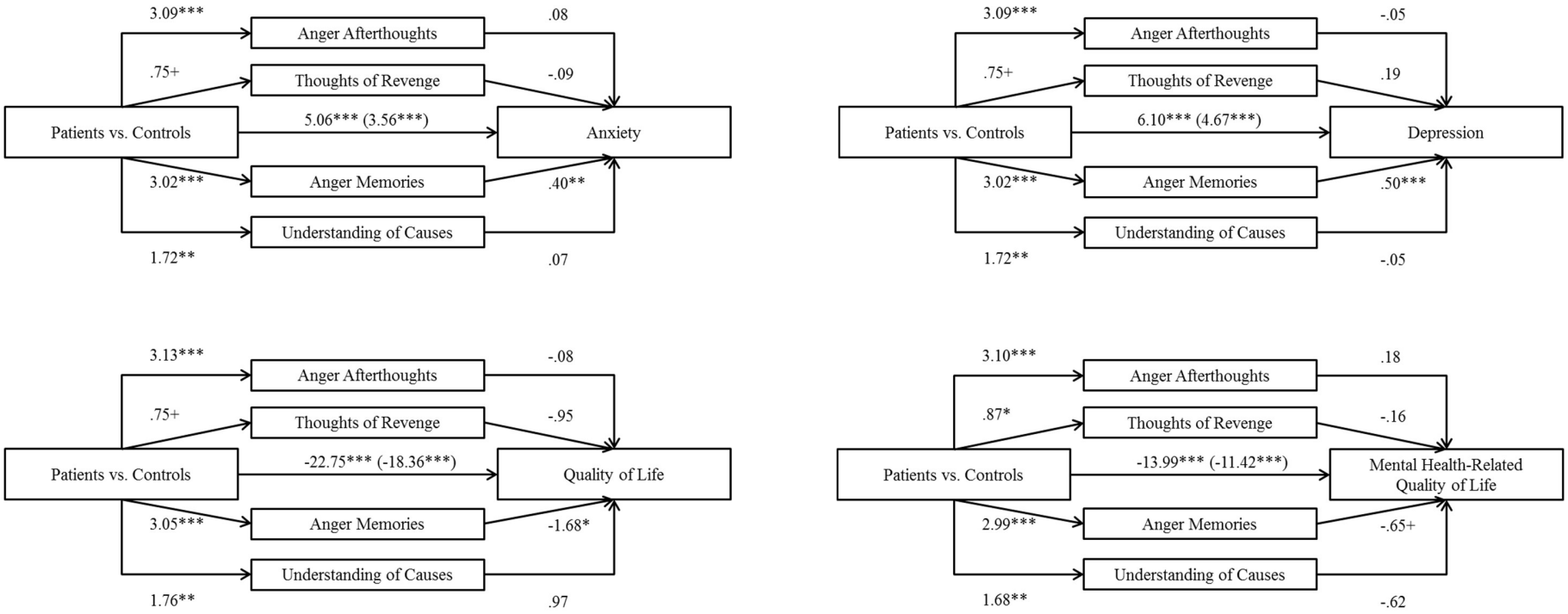

Figure 2. Multiple mediator models with anger afterthoughts, thoughts of revenge, anger memories, and understanding causes as mediators. Anger memories, but not anger afterthoughts, thoughts of revenge, or understanding causes, mediate differences between FMS patients and healthy controls on mental health and quality of life outcomes. Total effects and direct effects (in parentheses) are included for patient-control differences on each outcome. All models control for the effects of age, gender, marital status, and education (not shown). + $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$.