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Emotional processing and its association to somatic symptom change in Emotional Awareness and Expression Therapy for Somatic Symptom Disorder: A preliminary investigation of mechanisms of change

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Conflict of interest statement

The authors declare a potential conflict of interest and state it below

Brjánn Ljótsson is shareholder of Dahlia Qomit AB, a company specializing in online psychiatric symptom assessment, and Hedman-Lagerlöf och Ljótsson Psykologi AB, that licenses a treatment manual for irritable bowel syndrome on a commercial basis. Howard Schubiner is the owner of Mind Body Publishing, a company that sells books written by Dr. Schubiner for patients dealing with mind body symptoms and for professionals who treat such patients.

Author contribution statement

DM and RJ designed the study, with ML in an advisory role. DM wrote the first draft of the manuscript. BL did the statistical analysis. All authors contributed to revising the manuscript and accepting its final version.

Keywords

emotional awareness and expression therapy, emotional processing, Emotional Processing Scale, Functional syndromes, Mediation analysis, Somatic symptom disorder

Abstract

Word count: 180

Objective: The aim of this study was to investigate emotional processing as a potential mediator in therapist-guided, internet-based Emotional Awareness and Expression Therapy (I-EAET) for somatic symptom disorder, using data from a previously published pilot study.

Method: Participants (N=52) engaged in a 9-week I-EAET treatment. Before treatment and each week during treatment (i.e., 10 weekly measurements), emotional processing was assessed with the Emotional Processing Scale-25 (EPS-25), which contains five subscales, and somatic symptoms were assessed with the Patient Health Questionnaire-15 (PHQ-15).

Results: Mediation analyses using linear mixed models showed that two EPS-25 subscales—Signs of Unprocessed Emotions and Impoverished Emotional Experience—were uniquely associated with somatic symptom reduction. The proportion of the mediated effect was 0.49, indicating that about half of the total association of the PHQ-15 with symptoms was accounted for by the two EPS-25 subscales.

Conclusion: This preliminary mediation analysis suggests that improved emotional processing is associated with change in somatic symptoms in I-EAET. However, randomized controlled and comparison trials are needed to establish that I-EAET creates the change in emotional processing and that such changes are specific to I-EAET.

Contribution to the field

Emotional awareness and Expression Therapy (EAET) is a newly developed therapy for patients with chronic somatic symptoms stemming from central sensitization or amplification. EAET proposes that addressing the consequences of trauma or stressful life events by increasing emotional awareness and engaging in emotional processing improve treatment outcomes for patients. However, little is known by what mechanisms EAET has it effects. Using a mediation analysis, we showed in this study that emotional processing as measured by the EPS-25 was related to change in somatic symptoms. More specifically, two subscales Signs of Unprocessed Emotions and Impoverished Emotional Experience, contributed uniquely to somatic symptom reduction. The proportion of the mediated effect was 0.49, indicating that about half of the total effect on somatic symptoms was accounted for by the two EPS-25 subscales. This result indicates that emotional processing might be an important mechanism of change in treatments of somatic symptoms.

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Ethics statements

Studies involving animal subjects

Generated Statement: No animal studies are presented in this manuscript.

Studies involving human subjects

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Inclusion of identifiable human data

Generated Statement: No potentially identifiable human images or data is presented in this study.

Data availability statement

Generated Statement: The datasets presented in this article are not readily available because participants did not consent to this. Therefore, the dataset is available on reasonable requests as deemed by the principal investigator of the study.. Requests to access the datasets should be directed to Principal Investigator Robert Johansson, robert.johansson@psychology.su.se.

Emotional Processing and its Association to Somatic Symptom Change in Emotional Awareness and Expression Therapy for Somatic Symptom Disorder: A Preliminary Mediation Investigation

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Keywords: Emotional Awareness and Expression Therapy, emotional processing, emotional processing scale, functional syndromes, mediation analysis, somatic symptom disorder

Abstract

Objective: The aim of this study was to investigate emotional processing as a potential mediator in therapist-guided, internet-based Emotional Awareness and Expression Therapy (I-EAET) for somatic symptom disorder, using data from a previously published pilot study.

Method: Participants (N=52) engaged in a 9-week I-EAET treatment. Before treatment and each week during treatment (i.e., 10 weekly measurements), emotional processing was assessed with the Emotional Processing Scale-25 (EPS-25), which contains five subscales, and somatic symptoms were assessed with the Patient Health Questionnaire-15 (PHQ-15).

Results: Mediation analyses using linear mixed models showed that two EPS-25 subscales—Signs of Unprocessed Emotions and Impoverished Emotional Experience—were uniquely associated with somatic symptom reduction. The proportion of the mediated effect was 0.49, indicating that about half of the total association of the PHQ-15 with symptoms was accounted for by the two EPS-25 subscales.

Conclusion: This preliminary mediation analysis suggests that improved emotional processing is associated with change in somatic symptoms in I-EAET. However, randomized controlled and comparison trials are needed to establish that I-EAET creates the change in emotional processing and that such changes are specific to I-EAET.

1 Introduction

Emotional Awareness and Expression Therapy (EAET) is a newly developed therapy for patients with chronic somatic symptoms stemming from central sensitization or amplification (Lumley and Schubiner, 2019). EAET, which integrates short-term psychodynamic therapy, emotion-focused therapy, and exposure therapy, proposes that addressing the consequences of trauma or stressful life events by increasing emotional awareness and engaging in emotional processing reduces patients' symptoms. EAET has been found to be superior to treatment as usual, education controls, or even CBT in randomized controlled trials in patients with fibromyalgia (Lumley et al., 2017), irritable bowel syndrome (IBS) (Thakur et al., 2017), pelvic pain (Carty et al., 2019), medically unexplained symptoms (Ziadni et al., 2018), and musculoskeletal pain (Yarns et al., 2020).

We have developed an internet-administrated version of EAET (I-EAET) that is self-guided but with therapist support (Maroti et al., 2021). I-EAET includes four components: a) pain neuroscience psychoeducation to help patients reattribute symptoms to central nervous system processes; b) the identification of possible connections between stressful life events and somatic symptoms; c) anxiety regulation via daily self-compassion meditations; and d) emotional exposure and processing using expressive writing and being more expressive and assertive in relationships. The emotional exposure component, which targets the processing of suppressed or avoided emotions, is thought to be the key component leading to somatic symptom reduction.

In an uncontrolled pilot trial (Maroti et al., 2021), 52 participants with somatic symptom disorder concurrent with central sensitization engaged in 9 weeks of I-EAET, which included weekly contact with an online therapist, who gave feedback on homework assignments. Within-treatment effect sizes were large for somatic symptom reduction at both post treatment and at 4-month follow up, and the majority of patients (71.2%) achieved at least a minimally clinically significant change in somatic symptoms.

Despite EAET's effectiveness, little is known about the mechanisms by which EAET achieve its effects. In theory, emotional processing is a key mechanism (Lumley and Schubiner, 2019), as deficits in emotional processing have been identified in patients with chronic pain and IBS (Baker et al., 2010; Esteves et al., 2013; Phillips et al., 2013; Gay et al., 2019), and problems in emotional processing have been found to mediate the association between childhood adversity and the

development of psychiatric (Chung and Chen, 2017) and somatic symptoms (Mozhgan et al., 2020). Facets of emotional processing, such as emotional differentiation, naming, experiencing, tolerating, and expression, are believed to be a core mechanism in psychodynamic treatments of certain conditions (Messer, 2013; Høglend and Hagtvet, 2019). For example, in a study of panic-focused psychodynamic treatment, expressions of sadness /grief lead to a reduction of panic symptoms (Keefe et al., 2019).

To investigate emotional processing in our pilot trial of I-EAET, we assessed changes in emotional processing and somatic symptoms before treatment and weekly during treatment. In this paper, we examined whether an increased capacity for emotional processing is related to reduced somatic symptoms during and following I-EAET.

2 Methods

2.1 Participants

The sample consisted of 52 participants (96.2 % female; mean age of 49.6 years) with somatic symptom disorder with centralized symptoms who self-referred for the trial. The most common somatic condition reported by patients was fibromyalgia (42.3% of patients). The sample had substantial psychiatric comorbidity, with over 80% of the participants having a psychiatric diagnosis. Nearly a third of the patients were on sick leave (30.8%), and two-thirds (n=35) had ongoing pharmacological treatment. A detailed description, including inclusion and exclusion criteria and treatment content is found in (Maroti et al., 2021).

2.2 Measures

The Emotional Processing Scale (EPS-25) (Baker et al., 2010; Gay et al., 2019) measures five facets of emotional processing (Impoverished Emotional Experience, Signs of Unprocessed Emotion, Avoidance, Suppression, and Unregulated Emotion). Items are rated from 0 (*completely disagree*) to 9 (*completely agree*) and averaged for each subscale. Lower scores indicate less difficulties on each facet of emotional processing. The EPS-25 subscales were analyzed as putative mediators in the present study.

The Emotional Processing Scale (EPS) was used to assess emotional processing. This scale has been validated in several studies, is widely used and has been translated to 13 languages (Baker et al., 2010; Orbegozo et al., 2018; Lauriola et al., 2021). It has been found to be sensitive to change following treatment (Baker et al., 2012; Williams et al., 2018).

The Patient Health Questionnaire-15 (PHQ-15). To investigate somatic symptoms, the Patient Health Questionaire-15 was employed. The PHQ-15 consists of 15 somatic symptoms that patients' rate *not bothered at all* (0), *bothered a little* (1), or *bothered a lot* (2); ratings are summed for a total score. The PHQ-15 was pre-defined as the trial's primary outcome. PHQ-15 is a well validated questionnaire (Kroenke et al., 2010) with fair to good psychometric properties in a Swedish population (Nordin et al., 2013) and has been found to be a moderately reliable questionnaire for the detection of somatic symptom disorder in the general population (Laferton et al., 2017). Moreover, PHQ-15 can adequately capture disease severity in patients with Fibromyalgia (Häuser et al., 2014) a condition with quite a substantial overlap with SSD (Axelsson et al., 2020). PHQ-15 have also been used as an indicator of treatment effect in several studies (Kroenke et al., 2006; Haggarty et al., 2016).

The instruments were administrated before the 9-week treatment and weekly during the treatment; that is, the dataset included 10 weekly measurements of both measures.

2.3 Statistical Analyses

Mediation analysis investigates the extent to the effect of a predictor variable on an outcome variable (usually treatment effect) is explained by the effect of predictor variable on a third variable, the mediator, which in turn affects the outcome. In the context of the data collected in the present study, the predictor in a mediation analysis is time or week; that is, we expected there to be an effect of treatment week on the outcome variable PHQ-15. Similarly, we expected that there would be an effect of time on the EPS subscales. Finally, we expected that over the 10 assessment points, there would be a relationship between the PHQ-15 and the EPS subscales. The aim of this mediation analysis, therefore, was to determine how much of the per-week improvement on the outcome (PHQ-15) was explained by change in the mediators (EPS-subscales) (Baron and Kenny, 1986; Preacher and Hayes, 2008). A stepwise mediation analysis was used. First, we determined the rate of weekly improvement on the outcome, PHQ-15, during the treatment (i.e., the *c*-path). Second, the association between treatment week and each of the mediators (i.e., one *a*-path for each mediator) was

investigated. Third, the relationship between each mediator and the PHQ-15 (i.e., *b*-path) throughout the treatment period was estimated, controlling for treatment week. This third step was initially performed separately for each mediator by itself as a single mediator analysis and then with all mediators together to form a multiple mediator analysis (Preacher and Hayes, 2008), to investigate each mediator's unique contribution to improvement in somatic symptoms. Lastly, the *a* and *b*-path estimate for each mediator (from the single and multiple mediator analyses) were multiplied to form *ab*-products, which is the indirect, or mediated effect (i.e., how much of the effect of treatment week on the outcome that is explained by change in the mediator). We also calculated the proportion of the total effect that was accounted for by the mediators, using the formula ab/c (Preacher and Kelley, 2011).

All analyses were performed in R (R Core Team, 2021) and used linear mixed models with random intercept to account for dependency between the weekly measurements. To determine confidence intervals for the indirect effects (the ab-products), 5000 bootstrap replications of all analyses were conducted. Statistically significant mediation meant that the confidence intervals did not contain zero (Preacher and Hayes, 2008).

3 Results

Table 1 depicts observed means, standard deviations, and number of observations for outcome and processes over the treatment period. Both PHQ-15 and EPS-25 showed a decreasing trend during treatment, implying a reduction in both somatic symptoms and emotional processing difficulties.

[TABLE 1]

3.1 Mediation analysis

Table 2 shows the results from the single and multiple mediator analyses. The estimated average weekly change on the PHQ-15 was 0.29 (95% CI [0.21, 0.37]). The EPS-25 total score also changed significantly during treatment, with a slope of 0.13 (95% CI [0.10, 0.16]. In the single mediator analysis, all five subscales of the EPS-25 had statistically significant *ab*-products, indicating that change in each EPS-variable was associated with change in PHQ (Table 2, left column). In the multiple mediator analysis however, where the five potential mediators competed in explaining the change in somatic symptoms (PHQ-15), only Signs of Unprocessed Emotions, and Impoverished

Emotional Experience subscales were significant (Table 2, right column). The total indirect effect (i.e., the sum of the *ab*-products for these two subscales in the multiple mediator model) was 0.15 [0.09, 0.24]. The proportion of the mediated effect was 0.49 (0.15/0.29), indicating that about half of the total effect on the PHQ-15 was accounted for by these two EPS-25 subscales.

[TABLE 2]

4 Discussion

This study is one of the first attempts to examine changes in emotional processing in a short-term emotion-focused therapy, I-EAET. We found that a reduction in emotional processing difficulties—that is, an increased capacity for adaptive emotional processing—was closely related to a reduction in somatic symptoms in patients with somatic symptom disorder who were receiving a 9-week trial of I-EAET. Two facets or subscales of emotional processing were specifically and uniquely linked to reduced somatic symptoms: an increased capacity to be in contact with and aware of emotions (i.e., reduction in EPS-25 subscale Impoverished Emotional Experience) or not getting stuck or being overwhelmed by intrusive emotions or memories (EPS-25 subscale Signs of unprocessed emotions). This finding underscores the importance of certain emotional processes as potential vehicles of change.

The subscale Impoverished Emotional Experience overlaps with the construct alexithymia (Baker et al., 2010). Alexithymia, or difficulties identifying, describing and sharing emotions, is known to be elevated in chronic pain conditions (e.g., migraine, fibromyalgia) and is positively associated with pain intensity and interference (Aaron et al., 2019). Alexithymia has long been considered difficult to treat (Ogrodniczuk et al., 2011; Sifneos, 1973) but recent studies show that it can be reduced (Cameron et al., 2014). Thus, the mediated effect of change in the subscale Impoverished emotional experience on somatic symptoms is both consistent with previous literature and plausible, given that EAET specifically aims to increase emotional awareness.

The EPS-25 subscale, Signs of Unprocessed Emotions, reflects emotions or traumatic memories that are not being processed properly but instead are intrusive and fragmented (Ehlers and Clark, 2000). Because EAET explicitly focuses on emotional exposure and fully processing emotions stemming from stressful life events, it is plausible that changes in this facet of emotional processing occurred during EAET. We propose that this finding is similar to that of treating post-traumatic stress disorder,

which also can contribute to a reduction in somatic symptoms and disability (Gupta, 2013).

The weekly change in somatic symptoms and emotional processing was quite modest with PHQ-15 falling an average of 0.29 points per week, and EPS-25 dropping 0.13 points. However, these weekly reductions sum to yield rather substantial reductions over the course of 9 weeks of therapy. For example, the minimally clinically important difference (MCID) for the PHQ-15 score is a reduction of at least 2.3 points (Toussaint et al., 2017), whereas an increase of only 1 point is predicts a 3% increase in health care use (Toussaint et al., 2017).

One obvious limitation of this study is that it did not include a control or comparison condition, thereby rendering it difficult to attribute changes in somatic symptoms and emotional processing to the treatment rather than factors such as history or maturation. Randomized controlled trials are needed to obtain greater certainty and specificity. Second, the mediation analysis in this study can establish only a correlation between PHQ-15 and EPS-25 but precludes causal inferences. Although improved emotional processing could reduce symptoms, it also is possible that reduced symptoms permit better emotional processing. However, the weekly measurements of the outcome PHQ-15 during the treatment period provide an indication of *potential* treatment effect because it is likely that these weekly changes are to some extent associated with participation in treatment. In line with the same reasoning, weekly changes observed on the EPS-25 subscales during the treatment period are likely be associated with participation in treatment. As EAET aims to improve somatic symptoms by changing emotional processing, an association of change in EPS-25 and change in PHQ-15 as found in this study, is coherent and possibly in line with assumptions of EAET.

Taken together, this study gives preliminary evidence that improvements in emotional processing are related to reductions in somatic symptoms in an internet-administered EAET treatment for patients with centralized persistent physical symptoms.

5 Conflict of Interest

The authors declare the following conflict of interest: Brjánn Ljótsson is shareholder of Dahlia Qomit AB, a company specializing in online psychiatric symptom assessment, and Hedman-Lagerlöf och Ljótsson Psykologi AB, that licenses a treatment manual for irritable bowel syndrome on a commercial basis. Howard Schubiner is the owner of Mind Body Publishing, a company that sells

books written by Dr. Schubiner for patients dealing with mind body symptoms and for professionals who treat such patients.

6 Author Contributions

DM and RJ designed the study, with ML in an advisory role. DM wrote the first draft of the manuscript. BL did the statistical analysis. All authors contributed to revising the manuscript and accepting its final version.

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8 Acknowledgments

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9 Data Availability Statement

The datasets presented in this article are not readily available because participants did not consent to this. Therefore, the dataset is available on reasonable requests as deemed by the principal investigator of the study. Requests to access the datasets should be directed to the Principal Investigator: Robert Johansson, robert.johansson@psychology.su.se.

10 Ethics Statement

Ethics statement: The studies involving human participants were reviewed and approved by Swedish Ethical Review Authority (Dnr 2019-03317). The patients/participants provided their written informed consent to participate in this study.

11 References

Aaron, R., Fisher, E., de la Vega, R., Lumley, M., and Palermo, T. (2019). Alexithymia in individuals with chronic pain and its relation to pain intensity, physical interference, depression, and anxiety: a systematic review and meta-analysis. *Pain.* 160, 994–1006. doi:10.1097/j.pain.0000000000001487.

Axelsson, E., Hedman-Lagerlöf, M., Hedman-Lagerlöf, E., Ljótsson, B., and Andersson, E. (2020). Symptom Preoccupation in Fibromyalgia: Prevalence and Correlates of Somatic Symptom Disorder in a Self-Recruited Sample. *Psychosomatics.* 61, 268–276. doi:10.1016/j.psym.2020.01.012.

Baker, R., Owens, M., Thomas, S., Whittlesea, A., Abbey, G., Gower, P., et al. (2012). Does CBT Facilitate Emotional Processing? *Behav. Cogn. Psychother.* 40, 19–37. doi:10.1017/S1352465810000895.

Baker, R., Thomas, S., Thomas, P., Gower, P., Santonastaso, M., and Whittlesea, A. (2010). The Emotional Processing Scale: Scale refinement and abridgement (EPS-25). *Journal of Psychosomatic Research.* 68, 83–88. doi:10.1016/j.jpsychores.2009.07.007.

Baron R, Kenny D. (1986). The moderator-mediator variable distinction in social psychological research: conceptual, strategic, and statistical considerations. *J Pers Soc Psychol.* 51(6), 1173–82.

Cameron, K., Ogrodniczuk, J., and Hadjipavlou, G. (2014). Changes in Alexithymia Following Psychological Intervention: A Review. *Harvard Review of Psychiatry.* 22, 162–178. doi:10.1097/HRP.0000000000000036.

Carty, J., Ziadni, M., Holmes, H., Tomakowsky, J., Peters, K., Schubiner, H., et al. (2019). The Effects of a Life Stress Emotional Awareness and Expression Interview for Women with Chronic Urogenital Pain: A Randomized Controlled Trial. *Pain Medicine.* 20, 1321–1329. doi:10.1093/pm/pny182.

Chung, M., and Chen, Z. (2017). Child Abuse and Psychiatric Co-morbidity Among Chinese Adolescents: Emotional Processing as Mediator and PTSD from Past Trauma as Moderator. *Child Psychiatry Hum Dev.* 48, 610–618. doi:10.1007/s10578-016-0687-7.

Ehlers, A., and Clark, D. (2000). A cognitive model of posttraumatic stress disorder. *Behaviour Research and Therapy.* 38, 319–345. doi:10.1016/S0005-7967(99)00123-0.

Esteves, J., Wheatley, L., Mayall, C., and Abbey, H. (2013). Emotional processing and its relationship to chronic low back pain: Results from a case-control study. *Manual Therapy.* 18, 541–546. doi:10.1016/j.math.2013.05.008.

Gay, M-C., Baker, R., Vrignaud, P., Thomas, P., Heinzlef, O., Haag, P., et al. (2019). Cross-cultural validation of a French version of the Emotional Processing Scale (EPS-25). *European Review of Applied Psychology.* 69, 91–99. doi:10.1016/j.erap.2019.05.002.

Gupta, M. A. (2013). Review of somatic symptoms in post-traumatic stress disorder. *International Review of Psychiatry.* 25, 86–99. doi:10.3109/09540261.2012.736367.

Haggarty, J., O'Connor, B., Mozzon, J., and Bailey, S. (2016). Shared mental healthcare and somatization: changes in patient symptoms and disability. *Prim Health Care Res Dev.* 17, 277–286. doi:10.1017/S1463423615000420.

Häuser, W., Brähler, E., Wolfe, F., and Henningsen, P. (2014). Patient Health Questionnaire 15 as a generic measure of severity in fibromyalgia syndrome: Surveys with patients of three different settings. *Journal of Psychosomatic Research.* 76, 307–311. doi:10.1016/j.jpsychores.2014.01.009.

Høglend, P., and Hagtvet, K. (2019). Change mechanisms in psychotherapy: Both improved insight and improved affective awareness are necessary. *Journal of Consulting and Clinical Psychology*. 87, 332–344. doi:10.1037/ccp0000381.

Keefe, J. R., Huque, Z. M., DeRubeis, R. J., Barber, J. P., Milrod, B. L., and Chambless, D. L. (2019). In-session emotional expression predicts symptomatic and panic-specific reflective

functioning improvements in panic-focused psychodynamic psychotherapy. *Psychotherapy.* 56, 514–525. doi:10.1037/pst0000215.

Kroenke K, Messina N 3rd, Benattia I, Graepel J, Musgnung J. (2006). Venlafaxine extended release in the short-term treatment of depressed and anxious primary care patients with multisomatoform disorder. *J Clin Psychiatry.* 67(1), 72-80. doi: 10.4088/jcp.v67n0111. PMID: 16426091.

Kroenke, K., Spitzer, R. L., Williams, J. B. W., and Löwe, B. (2010). The Patient Health Questionnaire Somatic, Anxiety, and Depressive Symptom Scales: a systematic review. *General Hospital Psychiatry.* 32, 345–359. doi:10.1016/j.genhosppsych.2010.03.006.

Laferton, J., Stenzel, N., Rief, W., Klaus, K., Brähler, E., and Mewes, R. (2017). Screening for DSM-5 Somatic Symptom Disorder: Diagnostic Accuracy of Self-Report Measures Within a Population Sample. *Psychosom Med.* 79, 974–981. doi:10.1097/PSY.0000000000000530.

Lauriola, M., Donati, M. A., Trentini, C., Tomai, M., Pontone, S., and Baker, R. (2021). The Structure of the Emotional Processing Scale (EPS-25): An Exploratory Structural Equation Modeling Analysis Using Medical and Community Samples. *European Journal of Psychological Assessment*. 1–10. doi:10.1027/1015-5759/a000632.

Lumley, M, and Schubiner, H. (2019). Emotional Awareness and Expression Therapy for Chronic Pain: Rationale, Principles and Techniques, Evidence, and Critical Review. *Curr Rheumatol Rep.* 21(7):30. doi:10.1007/s11926-019-0829-6.

Lumley, M., Schubiner, H., Lockhart, N., Kidwell, K., Harte, S., Clauw, D. J., et al. (2017). Emotional awareness and expression therapy, cognitive behavioral therapy, and education for fibromyalgia: a cluster-randomized controlled trial. *Pain.* 158, 2354–2363. doi:10.1097/j.pain.0000000000001036.

Maroti, D., Ek, J., Widlund, R-M., Schubiner, H., Lumley, M. A., Lilliengren, P., et al. (2021). Internet-Administered Emotional Awareness and Expression Therapy for Somatic Symptom Disorder With Centralized Symptoms: A Preliminary Efficacy Trial. *Front. Psychiatry.* 12, 620359. doi:10.3389/fpsyt.2021.620359.

Messer, S. B. (2013). Three mechanisms of change in psychodynamic therapy: Insight, affect, and alliance. *Psychotherapy.* 50, 408–412. doi:10.1037/a0032414.

Mozhgan F., Behrouz D., Abbas P., Mahmoud D., Mohsen Nouri Y., and Zahra M. (2020). Modeling the relationship between attachment styles and somatic symptoms with the mediating role of emotional processing. *J Educ Health Promot.* 9:157. doi:10.4103/jehp.jehp_102_20.

Nordin, S., Palmquist, E., and Nordin, M. (2013). Psychometric evaluation and normative data for a Swedish version of the Patient Health Questionnaire 15-Item Somatic Symptom Severity Scale: *Health and Disability*. *Scandinavian Journal of Psychology.* 54, 112–117. doi:10.1111/sjop.12029.

Ogrodniczuk, J., Piper, W, and Joyce, A. (2011). Effect of alexithymia on the process and outcome of psychotherapy: A programmatic review. *Psychiatry Research.* 190, 43–48. doi:10.1016/j.psychres.2010.04.026.

Orbegozo, U., Matellanes, B., Estévez, A., and Montero, M. (2018). Adaptación al castellano del Emotional Processing Scale-25. *Ansiedad y Estrés.* 24, 24–30. doi:10.1016/j.anyes.2017.10.006.

Phillips, K., Wright, B. J., and Kent, S. (2013). Psychosocial predictors of irritable bowel syndrome diagnosis and symptom severity. *Journal of Psychosomatic Research.* 75, 467–474. doi:10.1016/j.jpsychores.2013.08.002.

Preacher, K., and Kelley, K. (2011). Effect size measures for mediation models: Quantitative strategies for communicating indirect effects. *Psychological Methods.* 16, 93–115. doi:10.1037/a0022658.

Preacher, K, and Hayes, A. (2008). Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behav Res Methods.* 40 (3), 879–91. doi:10.3758/BRM.40.3.879.

R Core Team. (2021). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL https://www.R-project.org/

Sifneos, P. (1973). The prevalence of 'alexithymic' characteristics in psychosomatic patients. *Psychother Psychosom*. 22(2), 255-62. doi: 10.1159/000286529. PMID: 4770536.

Thakur, E., Holmes, H., Lockhart, N., Carty, J., Ziadni, M., Doherty, H., et al. (2017). Emotional awareness and expression training improves irritable bowel syndrome: A randomized controlled trial. *Neurogastroenterol Motil*. 29(12):10.1111/nmo.13143. doi: 10.1111/nmo.13143.

Toussaint, A., Kroenke, K., Baye, F., and Lourens, S. (2017). Comparing the Patient Health Questionnaire – 15 and the Somatic Symptom Scale – 8 as measures of somatic symptom burden. *Journal of Psychosomatic Research.* 101, 44–50. doi:10.1016/j.jpsychores.2017.08.002.

Williams, I., Howlett, S., Levita, L., and Reuber, M. (2018). Changes in Emotion Processing following Brief Augmented Psychodynamic Interpersonal Therapy for Functional Neurological Symptoms. *Behav. Cogn. Psychother.* 46, 350–366. doi:10.1017/S1352465817000807.

Yarns, B., Lumley, M., Cassidy, J., Steers, W., Osato, S., Schubiner, H., et al. (2020). Emotional Awareness and Expression Therapy Achieves Greater Pain Reduction than Cognitive Behavioral Therapy in Older Adults with Chronic Musculoskeletal Pain: A Preliminary Randomized Comparison Trial. *Pain Medicine.* 21, 2811–2822. doi:10.1093/pm/pnaa145.

Ziadni, M., Carty, J., Doherty, H., Porcerelli, J., Rapport, L., Schubiner, H., et al. (2018). A life-stress, emotional awareness, and expression interview for primary care patients with medically unexplained symptoms: A randomized controlled trial. *Health Psychology* 37, 282–290. doi:10.1037/hea0000566.

Table 1. Observed means, standard deviations, and number of observations for outcome and processes over the treatment period.

Week	0	1	2	3	4	5	6	7	8	9
N	48	52	51	50	46	46	45	45	45	52
PHQ-15 Mean (SD)	13.77 (3.68)	13.4 (3.77)	13.47 (3.91)	12.38 (3.83)	11.76 (4.71)	12.45 (3.83)	11.57 (4.54)	11.76 (4.15)	11.24 (4.4)	10.98 (4.95)
EPS-25 Mean (SD)	4.23 (1.6)	4.00 (1.7)	4.17 (1.74)	3.63 (1.93)	3.56 (2.08)	3.59 (1.86)	3.31 (2.06)	3.2 (2.02)	3.11 (1.92)	3.02 (2.14)
IEE	3.02 (2.10)	2.65 (1.99)	2.89 (2.23)	2.50 (2.18)	2.26 (2.04)	2.31 (2.14)	2.41 (2.33)	2.08 (1.97)	2.16 (2.18)	1.85 (2.20)
AVO	3.81 (1.96)	3.84 (2.05)	4.26 (2.33)	3.48 (2.30)	3.49 (2.48)	3.32 (2.41)	3.10 (2.29)	2.94 (2.35)	3.15 (2.22)	2.97 (2.34)
UNE	5.57 (2.37)	5.34 (2.40)	5.42 (2.56)	4.44 (2.59)	4.69 (2.65)	4.98 (2.48)	4.27 (2.87)	4.47 (2.72)	3.89 (2.81)	3.71 (2.87)
SUP	4.97 (2.34)	4.72 (2.52)	4.86 (2.43)	4.65 (2.73)	4.04 (2.90)	4.25 (2.93)	3.80 (2.54)	3.58 (2.62)	3.75 (2.60)	3.83 (2.56)
UNG	3.78 (1.88)	3.47 (1.92)	3.40 (2.06)	3.06 (2.13)	3.32 (2.50)	3.10 (2.16)	2.96 (2.41)	2.93 (2.27)	2.60 (1.83)	2.75 (2.33)

PHQ-15 = Patient Health Questionnaire (PHQ-15), EPS-25 = Emotional processing scale-total, IEE= Impoverished emotional experience, ACO=Avoidance, UNE=Unprocessed emotions, SUP=Suppression, UNG=Unregulated emotions

Table 2. Indirect effects, *ab*-product, of the five tested mediators of the effect of treatment week on the primary outcome measure PHQ-15.

	Single mediator analysis			**Multiple mediator Analysis**	
Mediator	*ab*	95% CI		*ab*	95% CI
EPS Impoverished Emotional Experience	0.09*	[0.05, 0.15]		0.054*	[0.03, 0.11]
EPS Signs of Unprocessed Emotion	0.11*	[0.06, 0.20]		0.068*	[0.03, 0.13]
EPS Avoidance	0.07*	[0.04, 0.13]		0.0016	[-0.04, 0.03]
EPS Suppression	0.07*	[0.04, 0.16]		0.012	[-0.01, 0.05]
EPS Unregulated Emotion	0.07*	[0.04, 0.15]		0.013	[-0.01, 0.05]
All mediators				0.15*	[0.09, 0.24]

*Statistical significance of indirect effects, *ab*-products, based on their respective bootstrapped 95% CIs not containing zero. Abbreviations: EPS = Emotional Processing Scale – 25 item version. PHQ-15 = Patient Health Questionnaire-15.