BEHAVIOURAL AND
COGNITIVE PSYCHOTHERAPY

CAMBRIDGE
UNIVERSITY PRESS

Changes in emotion processing following Brief Augmented Psychodynamic Interpersonal Therapy for Functional Neurological Symptoms

Journal:	*Behavioural and Cognitive Psychotherapy*
Manuscript ID	Draft
Manuscript Type:	Main
Keywords:	Functional Neurological Symptoms, Emotion Processing, Psychopathology, Quality of Life

Abstract

Background: Functional Neurological Symptoms (FNS) are considered non-volitional and potentially highly disabling, but are not explainable by neurological disease or structural abnormalities. Brief Augmented Psychodynamic Interpersonal Therapy (BAPIT), was adapted to treat the putative emotion processing deficits thought to be central to FNS aetiology and maintenance. BAPIT for FNS has previously been shown to improve levels of distress and functioning, but it is unknown whether improvements on such measures correlate with improvements in emotion processing - which this treatment focuses on.

Aim: To determine a) whether the recently developed Emotional Processing Scale-25 can be used to demonstrate BAPIT-associated changes in patients with FNS, and b) whether changes in the EPS-25 are associated with changes in previously validated outcome measures.

Method: 44 patients with FNS completed questionnaires including the EPS-25 and measures of clinical symptomology (health-related quality of life (SF-36), somatic symptoms (PHQ-15), psychological distress (CORE-10), illness understanding (BIPQ)) pre- and post-therapy.

Results: Emotion processing improved following therapy (p = .049). Some measures of clinical symptomology also improved,

namely health-related quality of life (p = 0.02) and illness understanding (p = 0.01). Improvements in the EPS-25 correlated with improvements in mental health-related quality of life and psychological distress.

Conclusions: Emotion processing and some measures of clinical symptomology improved in patients with FNS following BAPIT. The EPS-25 demonstrated changes which correlated with previously validated outcome measures and should therefore be suitable as a measure of psychotherapy-associated change in the FNS patient population.

Keywords: Functional Neurological Symptoms, Emotion processing, Psychopathology, Quality of life

Changes in emotion processing following Brief Augmented Psychodynamic Interpersonal Therapy for Functional Neurological Symptoms

Functional Neurological Symptoms (FNS) are manifestations of altered motor or sensory functions not caused by readily identifiable structural or pathophysiological changes in the nervous system (Carson et al., 2012). The DSM-V refers to FNS as 'Conversion Disorder' (American Psychiatric Association, 2013) and the ICD-10 as 'Somatoform Disorder' (World Health Organization, 2016). In both nosologies FNS should not be better explained by other known diagnoses. FNS may present as movement disorders, including weakness and tremor. FNS may also affect sensory processing and include symptoms such as anaesthesia or visual deficits. Nonepileptic Attack Disorder (NEAD), is a paroxysmal FNS involving episodes of altered consciousness. Approximately one third of neurology outpatients present with FNS (Stone, 2013). The long-term prognosis is variable but often poor, as FNS are associated with as much or more significant disability, distress, and unemployment as other "medically explained" conditions presenting to neurologists (Carson et al., 2011).

The existing categorization of FNS as a 'Conversion Disorder' reflects the on-going assumption that psychological

difficulties may contribute to their aetiology (American Psychiatric Association, 2013). Indeed, an interaction between pre-disposing, precipitating, and perpetuating factors linked to abnormal emotion processing has been proposed as mechanistic in FNS aetiology (Carson et al., 2012). 'Emotion processing' describes the process by which, "emotional disturbances are absorbed, and decline to the extent that other experiences and behaviours can proceed without disruption." (p.51) (Rachman, 1980). According to this model, abnormal emotion processing occurs when emotional disturbances are not satisfactorily absorbed by an individual. Disrupted emotion processing may be evident through direct signs, including intrusive thoughts, irritability, or inappropriate expressions of emotion. Rachman argues that there are also 'indirect' signs of unsatisfactory emotion processing, including fatigue, insomnia, and anorexia (Rachman, 1980). Abnormal emotion processing theoretically contributes to the symptomatology of multiple mental health difficulties and personality disorders, including anxiety and emotionally unstable (borderline) personality disorder (Kret & Ploeger, 2015).

Emotion processing is a multi-faceted concept; consequently there are multiple instruments measuring different aspects of emotion processing, such as the Difficulties in Emotion Regulation Scale (Gratz & Roemer, 2004) and the Toronto Alexithymia Scale (Bagby, 1994). The Emotional

Processing Scale (EPS-38)(Baker, Thomas, Thomas, & Owens, 2007) was developed to create one unified, psychometrically sound measurement of emotion processing (Baker et al., 2007). It has been used to demonstrate improvements in emotion processing and sensitivity to changes in alexithymia as well as psychiatric symptom severity following Cognitive Behavioural Therapy (Baker et al., 2012). The Emotional Processing Scale (EPS-25) (Baker, Thomas, Thomas, Santonastaso, & Corrigan, 2015) was later created as a shortened version of the EPS-38, with subscales measuring five key variants of abnormal emotion processing; namely suppression, signs of unprocessed emotion, unregulated emotion, avoidance, and impoverished emotional experience.

Several self-report and experimental studies have provided evidence of abnormal emotion processing in patients with FNS. This research has primarily focused on NEAD (Roberts & Reuber, 2014). In a study by Novakova et al. (Novakova, Howlett, Baker, & Reuber, 2015) patients with NEAD exhibited greater impairments in emotion processing on the EPS-25 than healthy controls. Impairments in emotion processing correlated with more severe somatic symptoms, greater psychological distress, and a poorer illness understanding. Another study demonstrated that patients with NEAD have greater difficulty in describing and identifying their emotions as well as possessing more negative beliefs

about emotions than healthy controls (Urbanek, Harvey, McGowan, & Agrawal, 2014). Abnormal attentional biases to emotional information and altered physiological markers of autonomic arousal are also evident in this population (Bakvis et al., 2009). Likewise, disrupted emotion processing is evident in patients with functional motor symptoms. Using event-related fMRI, Aybek et al. demonstrated an increased amygdala response amplitude to fearful imagery, suggesting altered emotion regulation (Aybek et al., 2015). Furthermore, patients with such symptoms have greater difficulty in identifying and describing emotions than controls (Demartini et al., 2014). Patients with functional motor symptoms also have lower interoceptive accuracy than healthy controls, elucidating a mechanism by which difficulties in emotion identification and processing could manifest (Ricciardi et al., 2015). Given the multiple forms of emotion processing impairments that have been identified in the FNS population, the administration of a single questionnaire in clinical or research settings may therefore be an efficient approach to capturing the range of emotional difficulties in this population.

The putative links between abnormal emotion processing and FNS suggest that patients could benefit from psychotherapeutic interventions aiming to improve emotion processing. Indeed, there is some evidence that Psychodynamic Interpersonal Therapy (PIT) can help patients with FNS; a brief

course of PIT was effective in a randomised control trial of patients with 'multisomatoform disorder' which included at least one FNS (Sattel et al., 2012). Brief Augmented Psychodynamic Interpersonal Therapy (BAPIT), is an augmented version of traditional PIT, with elements of somatic trauma therapy. BAPIT was adapted specifically to address FNS (Howlett & Reuber, 2009; Sattel et al., 2012) and assumes that psychological difficulties result from interpersonal conflicts in early life. Deep-rooted and commonly occurring issues in this population, such as childhood trauma or neglect are addressed (Reuber, Howlett, Khan, & Grunewald, 2007). The therapeutic targets of BAPIT include deficits in emotion processing (including the naming, tolerance, and expression of emotions) thought to play a role in FNS aetiology. BAPIT has been associated with significant improvements in psychological distress, mental health, physical health, and healthcare utilization in patients with FNS (Reuber, Burness, Howlett, Brazier, & Grunewald, 2007). In patients with NEAD, BAPIT has also been associated with sustained improvements in seizure control and healthcare utilisation (Mayor, Howlett, Grunewald, & Reuber, 2010). However, whilst BAPIT aims to improve emotion processing, it has not yet been examined whether the treatment-associated improvements in outcome measures are associated with similar improvements in emotion processing. What is more, the EPS-25 is a novel questionnaire,

and it has not yet been demonstrated whether it is sensitive to therapy-associated changes in emotion processing in the FNS population.

The aim of the present study was therefore to explore whether emotion processing as measured by the EPS-25 improved following a course of BAPIT. We also aimed to see whether changes seen in health-related quality of life (HRQoL) and some measures of relevant clinical symptomology (psychological distress, illness understanding, and somatic symptoms) correlated with changes in the EPS-25 scores. Finally, we aimed to see whether EPS-25 change scores were sensitive to changes in the measures of clinical symptomology used in this study. Given the theorised causal links between abnormal emotion processing and FNS, we predicted that patients would experience therapy-associated improvements in emotion processing, HRQoL, and clinical symptomology. We also predicted that changes in EPS-25 scores would correlate with changes in measures of HRQoL and measures of clinical symptomology.

Methods

Regulatory approvals

This study was granted ethical approval by the Sheffield Local Research Ethics Committee (REC 09/H1308/2; 01/05/2009). Research governance approval was given by the

research departments of the Sheffield Teaching Hospitals Foundation Trust and the Barnsley Hospital NHS Foundation Trust.

Participants

Patients with FNS were recruited consecutively from referrals to Neurology Psychotherapy Services at the Barnsley Hospital and the Royal Hallamshire Hospital. The FNS diagnosis was formulated by Consultant Neurologists on the basis of all available clinical information. Neurologists were sufficiently certain about this diagnosis to recommend psychological treatment and withdraw treatment for alternative neurological diagnoses (e.g. antiepileptic drugs). All patients provided written informed consent.

Treatment

BAPIT is based on an adapted version of PIT (Hobson, 1985), which assumes that dysfunctional interpersonal patterns originating from childhood are mechanistic in the development of abnormal emotion processing. We have described this approach in greater detail elsewhere (Howlett & Reuber, 2009). BAPIT is intended to improve emotion processing, increase symptom control, change illness perceptions, and improve quality of life through increasing independence and encouraging self-care. In view of the heterogeneous pre-disposing, precipitating, and perpetuating factors contributing

to the aetiology of FNS, BAPIT is based on a personalised assessment of each patient and can also include elements traditionally associated with Cognitive Behavioural Therapy such as goal-setting, exposure, and relaxation. If the patient has problems with hyper- or hypo-arousal (often occurring in the context of a trauma history), elements of Somatic Trauma Therapy, designed to allow patients to control autonomic arousal, identify personal triggers, and process traumatic memories, are incorporated (Rothschild, 2000). Help from carers may be recruited if appropriate (Howlett & Reuber, 2009).

In practice, therapists employ 'here and now' techniques to help the patient notice, tolerate, and understand emotions arising in the session. The patient is encouraged to stay with emotions as they manifest, notice their location in the body, and describe what they feel as a way of linking the emotion to associated physical symptoms / sensations e.g., "I wonder where you can feel that anger in your body right now?" Linking hypotheses are used to connect between current and other feelings both inside and outside the therapy room e.g., "You say you're feeling angry and frustrated now. I wonder if that's a bit like you used to feel as a child when that teacher showed you up in front of the class?"

A single psychotherapist delivered therapy. Psychotherapy duration was tailored to the patients' needs but

was intended to be brief (with a notional maximum number of 20 sessions). The initial session lasted two hours. All remaining sessions lasted 50 minutes. Progress was reviewed after six-eight sessions. Further sessions were offered if the patient was considered to have engaged with therapy and if there was a therapeutic need for further sessions agreed upon by both the patient and the therapist. The end of therapy was agreed upon between the two parties when the 20-session limit was reached or when both parties agreed that therapy was complete (in four cases, the therapy was extended beyond 20 sessions because of individual patients' particular needs and circumstances).

Design and procedure

This was a prospective, uncontrolled study with a within-subjects design. Study information was sent to patients along with their first psychotherapy assessment appointment letter. FNS diagnosis was re-explained at assessment. Patients were screened for factors suggesting they should be excluded from outpatient psychotherapy at this point (including risk of suicide, serious psychiatric conditions or current addictions). Patients were then given a range of symptom-appropriate self-help strategies, a relaxation CD, and self-help literature. Patients were telephoned to check whether their symptoms persisted and to arrange regular therapy sessions two months from assessment. Pre-intervention questionnaires were posted along with the appointment letter to those who agreed to further

sessions. Patients were asked to return the questionnaire battery in a pre-paid envelope. Patients failing to do so were given an opportunity to complete the pre-intervention questionnaires immediately before the first therapy session. The first therapy session took place approximately three months after the initial assessment visit.

Immediately after discharge (either planned or following a failure to attend and contact), participants were sent a post-intervention self-report questionnaire battery to complete and return using a pre-paid envelope. To reduce attrition, participants were mailed another copy of the questionnaires if they had failed to return the initial post-intervention questionnaires. Pre- and post-intervention data were collected by an assistant who had not been involved in the administration of psychotherapy. Patients who did not complete and return the post-intervention questionnaire pack were classified as 'study non-completers' and excluded from the analysis.

Measures

Demographic, referral and psychotherapy questionnaires.

Demographic and clinical information was provided by patients, referring neurologists, and the psychotherapist. Information regarding the FNS diagnosis was provided by the neurologist. Personal information was provided by the

participant. An 'end of therapy summary' including information about the number of sessions, reason for the end of therapy, and the issues tackled in therapy was provided by the psychotherapist.

The Emotional Processing Scale (EPS-25).

The EPS-25 is a standardised 25-item self-report scale measuring emotion processing styles and deficits. There are five subscales: suppression, signs of unprocessed emotions, unregulated emotion, avoidance, and impoverished emotional experience (Baker et al., 2009). The EPS-25 has been used in patients with lower back pain (Esteves, Wheatley, Mayall, & Abbey, 2013), Post-Traumatic Stress Disorder (Compare et al., 2012), and patients with NEAD (Novakova et al., 2015) but not in a sample of patients with mixed FNS. Responses are given on a 0-9 Likert scale. There are also three open-ended questions. Higher scores indicate greater difficulties with emotion processing. As per the administrator's manual, single missing items were replaced by the mean of the subscale (Baker et al., 2015).

The Short Form- 36 (SF-36).

The SF-36 is a standardised 36-item self-report questionnaire that measures nine areas of Health Related Quality of Life (HRQoL): physical functioning, role limitation - physical, role limitation - emotional, general health, mental

health, bodily pain, vitality, health transition, and social functioning. Responses are given on scales ranging from three to ten options. Higher scores indicate a better HRQoL. Missing items were dealt with as recommended by the user manual (Ware, Kosinski, & Gandek, 2000). Remaining scores were recoded and standardised using norm-based scoring. Scores were combined into physical (PHS) and mental health (MHS) summary scales, as per the procedure detailed in the manual.

Clinical Outcome in Routine Evaluations (CORE-10).

The CORE-10, is a standardised ten-item self-report scale measuring global psychological distress, taken from the 34 item CORE-OM (Outcome Measure)(Connell & Barkham, 2007). It has been used in studies of patients with FNS (Reuber, Burness, et al., 2007). On a Likert scale (0-4), higher responses indicate a higher level of psychological distress experienced over the last week. The CORE-10 is known to correlate strongly with the Beck Depression Inventory (Beck, Erbaugh, Ward, Mock, & Mendelsohn, 1961; Connell & Barkham, 2007).

Patient Health Questionnaires (PHQ-15).

The PHQ-15 is a standardised 15-item self-report questionnaire designed to measure common somatic symptoms, e.g. stomach pain or trouble sleeping (Kroenke, Spitzer, & Williams, 2002). Participants indicate how bothered they have

been by a symptom over the past week, on a three-point Likert scale. Higher scores indicate that participants have been bothered more by a particular symptom. A pattern of missing items emerged, whereby items 4 and 11 were not responded to by 14 and 8 participants respectively. These items may not have been relevant to the participants and so were dropped from the analysis, replicating the procedure adopted in a previous paper (Novakova et al., 2015).

Brief Illness Perception Questionnaire (BIPQ).

The BIPQ is a standardised nine-item self-report scale measuring emotional and cognitive representations of illness (Broadbent, Petrie, Main, & Weinman, 2006). For eight items, participants respond on a 0-10 Likert Scale. The 9th item is an open-ended question. The items represent nine dimensions of illness perception including consequences, personal control, treatment control, timeline, illness concern, coherence, identity, emotional representation, and causation. Responses were scored and missing items were dealt with as per the scoring instructions.

Statistical analysis

Data were analysed using SPSS Version 22.0 (IBM Corp, 2013). Prior to the use of inferential statistics, all scales scores were screened for normality. The EPS-25 and SF-36 scale scores were non-normally distributed. Therefore, all

analyses of scale scores were bootstrapped using 95% confidence intervals based on 1000 samples to control for non-normality. The p value was set at $p = 0.05$ (two-tailed hypothesis). Otherwise, the inflated risk of Type 1 error associated with multiple comparisons was controlled for using the Holm-Bonferroni method to correct p values when more than one comparison or correlation was being made.

Repeated measures ANOVAs with Bonferroni corrections were used to compare group mean scores on the EPS-25 and SF-36 self-report scales pre- versus post-intervention. The ANOVA model is robust to violations of normality when group sizes are equal, as is the case in the present study (Field, 2013). Change scores were calculated such that positive values corresponded to improvements in functioning across all scales. Pearson's product moment correlation coefficients were used to calculate the relationship between change scores on the EPS-25 and the other clinical variables. Partial correlation coefficients were used to explain the amount of variance shared between EPS-25 change scores and any significantly correlated clinical symptomology / HRQoL scores.

3.2. Internal consistency of the Emotion Processing Scale- 25

Responses on the EPS-25 were combined into total scores for pre- and post-intervention and assessed for internal consistency reliability. Internal consistency was excellent when

administered both before (α = .962) and after (α = .967) intervention.

Results

Patient characteristics

One hundred and eighteen patients consented to the study. Of this group, 72 returned the pre- and 44 also the post-intervention questionnaire (Figure 1). The final sample therefore consisted of 44 patients. 77.3% (34) were female and the mean age was 41.5 years (*SD* = 13.5). 63% of the sample were economically inactive (defined as unemployed, in receipt of disability benefits, or being retired due to ill-health or old age). Mean symptom duration was 5.4 years (*SD* = 10.8). The mean time between completion of the pre- and post-intervention questionnaires was 11.0 months.

Patients had different main FNS. To explore the justification of analysing patients with different FNS together, we divided the total group into two subgroups (NEAD and 'other FNS'). We compared these two groups on key demographic and therapy variables. There were no differences between the two groups on the mean number of sessions they completed, the number who completed therapy, economic activity, gender, and age at the start of therapy (Supplementary

Table 1). Mean pre-intervention total EPS-25 scores did not differ between these FNS groups; $t(42) = .11$, $p = .91$, 95% CI [-1.17, 1.49].

The patient sample also included those who had completed therapy in the judgement of the therapist ($n = 26$) and those who had not ($n = 17$). Reasons for non-completion of therapy included therapy was non-appropriate ($n = 2$), the patient was not progressing ($n = 2$), the patient improved after the initial session ($n = 1$), the patient dropped out ($n = 9$), and 'other' ($n = 2$). To explore the justification of including both patients who completed therapy and those who did not in the analysis, both groups of patients were compared on baseline emotion processing and clinical symptomology (Supplementary Table 2). There were no differences between the two groups on any of these measures.

On the basis that the remaining 44 patients with FNS did not differ significantly on baseline measures of emotion processing and clinical symptomology, irrespective of FNS semiology or therapy completion, we analysed the group as a whole.

[FIGURE 1]

Treatment-associated changes in emotion processing

Patients' pre-intervention EPS-25 scores indicated levels of emotion processing problems above normative healthy values for the UK, with the mean total EPS-25 scores of the FNS sample falling within the top 25th percentile of normative values, and well within pain and mental health norms (M = 4.96, SD = 2.26) (Baker et al., 2015). This indicates that emotion processing problems were common in this patient group before the intervention.

The EPS-25 total score and subscale scores were lower post-intervention (Table 1). A two-way repeated measures ANOVA with time point (pre- and post-intervention) and EPS-25 subscale (suppression, unprocessed emotion, unregulated emotion, avoidance, and impoverished emotional experience) as the within-subjects factors showed that there was a significant main effect of time point; $F(1,43) = 4.09$, $p = .049$, $\eta_p^2 = 0.09$, indicating that emotion processing improved significantly post-intervention. There was also a significant main effect of subscale; $F(4,172) = 10.13$, $p < .001$, $\eta_p^2 = 0.19$, suggesting that the mean scores on each subscale differed from each other both pre- and post-intervention. There was no significant interaction between time point and subscale, indicating that the relationship between the mean subscale scores did not vary over time; $F(4,172) = 0.923$, $p = 0.45$, $\eta_p^2 =$

0.02. Therefore, as measured by the EPS-25, emotion processing improved following BAPIT.

[TABLE 1]

Treatment-associated changes in routine outcome measures

HRQoL improved following intervention. The post-intervention PHS score (M = 38.10, SD = 11.95) was greater than the pre-intervention PHS score (M = 36.24, SD = 11.45). Likewise, the post-intervention MHS score (M = 42.31, SD = 11.12) was greater than the pre-intervention MHS score (M = 40.10, SD = 10.11). A two-way repeated measures ANOVA conducted on the SF-36 summary scales (PHS and MHS) with time point (pre- and post-intervention) as the within-subjects factors showed a significant main effect of time point, indicating that SF-36 scores were significantly higher (better quality of life) for both the MHS and PHS scores post-intervention; $F(1,38) = 5.94$, $p = .02$, $\eta_p^2 = 0.14$. There was no significant main effect of SF-36 summary scale; $F(1,38) = 2.69$, $p = 0.11$, $\eta_p^2 = 0.07$. There was no significant interaction effect; $F(1,38) = .018$, $p = 0.89$, $\eta_p^2 = .00$.

Post-intervention BIPQ scores (M = 48.83, SD = 15.79) were lower than pre-intervention scores (M = 55.51, SD = 11.84). This improvement in illness understanding was significant; $t(32) = 2.95$, $p = .01$, 95% CI [2.57, 12.39]. While

CORE-10 scores were also lower post-intervention (M = 17.05, SD = 10.43) than pre-intervention (M = 19.19, SD = 9.39), this reduction in psychological distress was not statistically significant; $t(42) = 1.54$, $p = 0.13$, 95% CI [-.69, 4.76]. Similarly, while PHQ-15 scores were lower post-intervention (M = 12.14, SD = 6.32) than pre-intervention (M = 14.05, SD = 5.35), reductions in the number and severity of somatic symptoms only approached significance following Holm-Bonferroni correction; $t(36) = 0.2.31$, $p = 0.03$, 95% CI [.35, 3.43].

Did treatment-associated changes on the EPS-25 correlate with changes in treatment outcome measures?

To assess whether the EPS-25 was sensitive to the measures of clinical symptomology and HRQoL of life used in this study, a series of correlational analyses were conducted on the scale change scores (Table 2). There were moderate to strong positive correlations between EPS-25 change scores, CORE-10, and MHS scale change scores. However, there were no significant correlations between EPS-25 change scores, PHQ-15 scores, BIPQ scores or PHS change scores. This suggests that improvements in emotion processing were associated with improvements in psychological distress and mental HRQoL, but not with a better understanding of symptoms, fewer somatic symptoms or improved physical HRQoL.

[TABLE 2]

Partial correlation coefficients were calculated to elucidate the relationship between the CORE-10 / MHS total scores and the EPS-25 total score when either CORE-10 or MHS-specific variance was controlled for. After controlling for the MHS total difference score, the correlation between the EPS-25 total difference score and the CORE-10 total difference score was smaller, and the amount of shared variance decreased, but the correlation was still statistically significant [partial correlation = .57, r^2 = .32, p < .001, 95% CI [.23, .83]]. Similarly, when controlling for the change in MHS scores, the correlation between the EPS-25 total difference scores and the CORE–10 total difference score was reduced, and the amount of shared variance reduced, but the correlation remained significant [partial correlation = .56, r^2 = .31, p < .001, 95% CI [.31, .84]]. These results indicate that EPS-25 change scores accounted for 45% and 40% of variance in CORE-10 and MHS change scores respectively.

Study non-completers

Seventy-four patients consented for the intervention did not provide complete follow-up data (Figure 1). Therefore, to examine whether attrition biased the results as far as possible, study completers were compared against study non-completers on a series of key variables. There were no associations between whether a patient completed the study and the

demographic variables of gender, economic activity, and FNS type. However, study non-completers were younger (M = 34.2 years, SD = 11.6) than study completers (M = 41.4 years, SD = 13.5); $t(75) = 2.48$, $p = .02$, 95% CI [-12.96, -1.87]. Study non-completers were also less likely to complete therapy (38.2% completed therapy, 61.8% did not complete therapy) in the judgement of the therapist; $\chi^2(1) = 5.91$, $p = .02$. However, the absence of clear differences between study completers and non-completers in terms of emotion processing and other baseline measures suggests that study completers were representative of the total consented sample on the available psychological parameters (Table 3).

[TABLE 3]

Discussion

Abnormal emotion processing is an important target for psychotherapy in patients with FNS because it may contribute to FNS aetiology (Novakova et al., 2015), and appears to be related to a poorer quality of life and understanding of the disorder (Baker et al., 2007). Therefore, the aim of this study was investigate whether emotion processing improved in patients with FNS following a course of BAPIT. We also explored the extent to which changes in emotion processing correlated with treatment-associated changes in HRQoL and other measures of clinical symptomology.

As predicted, emotion processing improved post-intervention, accompanied by improved HRQoL and illness understanding. Although psychological distress and other somatic symptoms failed to improve significantly, change scores on the EPS-25 correlated positively with change scores on the CORE-10 and MHS sharing 45% and 40% of variance respectively. This suggests that improvements captured by the EPS-25 are not simply of academic interest but clinically meaningful to patients.

To our knowledge this the first study to examine therapy-associated changes in emotion processing in patients with FNS. The significant improvement in HRQoL observed in our patient group is consistent with our previous observations in this patient population (Reuber, Burness, et al., 2007). However, this time we did not observe significant improvements in somatic symptoms or psychological distress. This discrepancy could be due to the smaller sample size in the present study reducing statistical power. Illness understanding was not measured in the previous study but we did observe a significant improvement in the present patient cohort. One earlier study in a much larger sample showed that having a poor illness understanding of FNS as measured by the Illness Beliefs Questionnaire (including a non-attribution of functional symptoms to psychological factors), is a strong predictor of

poor patient outcome on a 'Clinical Global Improvement Scale' at twelve month follow-up (Sharpe et al., 2010).

The present pre-intervention EPS-25 scores support previous observations that many patients with FNS experience abnormal emotion processing. Group mean pre-intervention total EPS-25 scores fell within the top 25th percentile for UK normative values and well within the range for mental health patients (Baker et al., 2007). When administered to patients with NEAD only, Novakova et al. observed similar abnormalities in emotion processing (Novakova et al., 2015). Here we extend this finding to include patients with other forms of FNS including functional motor and sensory symptoms.

The breadth of emotion processing styles assessed by the EPS-25 is a strength of this study. It could be argued that other forms of emotion processing measurement fail to reflect the multi-faceted nature of emotion perception, regulation, and expression (Baker et al., 2007). Therefore, the EPS-25 is likely to be well-suited to detecting the heterogeneous abnormalities of emotion processing which other studies have found to be associated with FNS (Carson et al., 2012). The fact that the EPS-25 was sensitive to changes in illness understanding and HRQoL, corroborate the usefulness of this scale in clinical and research settings of patients with FNS.

Limitations

The high attrition rate is a regrettable limitation of this study. As is often the case with postal-questionnaire designs, a significant proportion of data were lost by patients' failure to return the follow-up questionnaires. Another limitation is the lack of control group or a pre-treatment monitoring period demonstrating a lack of spontaneous improvements in emotion processing. Although spontaneous clinical improvements may be considered unlikely in view of the chronicity of the functional disorders treated in this study (mean duration of 5.8 years (SD = 10.8)), these limitations introduce the possibility that any improvements in emotion processing, HRQoL, and clinical symptomology could simply reflect regression to the mean. Furthermore, mechanism or direction of therapeutic change cannot be inferred. Although we only found an age difference between the patient groups completing and not completing BAPIT, the generalizability of our study findings is diminished by the fact that older patients were more likely to complete treatment than younger ones. This age disparity in therapy completion resonates with earlier studies noting a greater probability of older patients engaging in specialist psychotherapy for FNS (Howlett, Grunewald, Khan, & Reuber, 2007). In view of the lack of a control group and the relatively high attrition rates in this study, the influence of BAPIT on emotion processing requires further clarification. While the delivery of BAPIT by a single, highly-trained and experienced

therapist (SH) means that there was a low risk of deviation from the therapeutic approach (Hobson, 1985; Howlett & Reuber, 2009), the absence of treatment data generated by other therapists also limits the generalizability of the findings presented here.

The fact that not all patients who contributed follow-up data had completed therapy and that these patients were retained in the analysis should be considered a strength of this study. The inclusion of these patients in our analysis should mean that the findings of our study come closer to the sort of effects on emotion processing BAPIT might achieve in real-life rather than research settings.

We were also able to exclude some other biases. Patients with NEAD and those with other FNS were matched on key demographic variables irrespective of FNS semiology, minimising the risks of bias associated with analysing a small and heterogeneous population as whole. Consecutive recruitment of participants from two sites further reduced risk of bias introduced by patient selection.

Conclusions

In this prospective, uncontrolled study of patients with FNS we provide preliminary evidence that emotion processing improves following a course of BAPIT, with simultaneous improvements in HRQoL and illness understanding.

Improvements in emotion processing correlated with a reduction in psychological distress as well as an improved mental HRQoL. We also conclude that the EPS-25 shows promise as a tool for the investigation of emotion processing deficits in patients with FNS. Future research should aim to replicate these preliminary findings in controlled studies with larger sample sizes.

Acknowledgements

We would like to thank the patients for their participation in this study. We would also like to thank Roy Indrasenan for his administrative support during the study.

Ethical statements

The authors have abided by the Ethical Principles of Psychologists and Code of Conduct as set out by the APA.

Conflict of interests

Ms Isobel Williams, Ms Stephanie Howlett, Dr.Liat Levita, and Prof. Markus Reuber have no conflict of interest with respect to this publication.

Financial support

This work with supported by the Ryder Briggs Trust & Neuroscience Research Fund (Grant number 004 (2013)).

Figure captions

Figure 1 – Flowchart of patient attrition

References

American Psychiatric Association. (2013). *Diagnostic and Statistical Manual of Mental Disorders* (5th ed.). Arlington, VA: American Psychiatric Association.

Aybek, S., Nicholson, T. R., O'Daly, O., Zelaya, F., Kanaan, R. A., & David, A. S. (2015). Emotion-motion interactions in conversion disorder: an FMRI study. *PLoS One, 10*(4), e0123273. doi:10.1371/journal.pone.0123273. eCollection 2015.

Bagby, R. M. (1994). The twenty-item Toronto Alexithymia scale—I. Item selection and cross-validation of the factor structure. *38*(1), 23–32. doi:10.1016/0022-3999(94)90005-1

Baker, R., Owens, M., Thomas, S., Whittlesea, A., Abbey, G., Gower, P., . . . Thomas, P. W. (2012). Does CBT Facilitate Emotional Processing? *Behavioural and Cognitive Psychotherapy, 40*(1), 19-37. doi:10.1017/s1352465810000895

Baker, R., Thomas, P., Thomas, S., Santonastaso, M., & Corrigan, E. (2015). The Emotional Processing Scale. Oxford, UK: Hogrefe.

Baker, R., Thomas, S., Thomas, P. W., Gower, P., Santonastaso, M., & Whittlesea, A. (2009). The Emotional Processing Scale: scale refinement and abridgement (EPS-25). *J Psychosom Res, 68*(1), 83-88. doi:10.1016/j.jpsychores.2009.07.007

Baker, R., Thomas, S., Thomas, P. W., & Owens, M. (2007). Development of an emotional processing scale. *J Psychosom Res, 62*(2), 167-178. doi:10.1016/j.jpsychores.2006.09.005

Bakvis, P., Roelofs, K., Kuyk, J., Edelbroek, P. M., Swinkels, W. A., & Spinhoven, P. (2009). Trauma, stress, and preconscious threat processing in patients with psychogenic nonepileptic seizures. *Epilepsia, 50*(5), 1001-1011. doi:10.1111/j.1528-1167.2008.01862

Beck, A. T., Erbaugh, J., Ward, C. H., Mock, J., & Mendelsohn, M. (1961). AN INVENTORY FOR MEASURING DEPRESSION. *Archives of General Psychiatry, 4*(6), 561-571.

Broadbent, E., Petrie, K. J., Main, J., & Weinman, J. (2006). The Brief Illness Perception Questionnaire. *J Psychosom Res, 60*(6), 631-637. doi:10.1016/j.jpsychores.2005.10.020

Carson, A. J., Brown, R., David, A. S., Duncan, R., Edwards, M. J., Goldstein, L. H., . . . Voon, V. (2012). Functional (conversion) neurological symptoms: research since the millennium. *J Neurol Neurosurg Psychiatry, 83*(8), 842-850. doi:10.1136/jnnp-2011-301860

Carson, A. J., Stone, J., Hibberd, C., Murray, G., Duncan, R., Coleman, R., . . . Sharpe, M. (2011). Disability, distress and unemployment in neurology outpatients with symptoms 'unexplained by organic disease'. *J Neurol Neurosurg Psychiatry, 82*(7), 810-813. doi:10.1136/jnnp.2010.220640

Compare, A., Del Forno, D., Callus, E., Giallauria, F., Vitelli, A., Buccelli, C., & Vigorito, C. (2012). Post-traumatic stress disorder, emotional processing and inappropriate implantable cardioverter-defibrillator shocks: clinical consideration by a single case report. *Monaldi archives for chest disease, 78*(3), 160-166.

Connell, J., & Barkham, M. (2007). *CORE-10 User Manual, version 1.1.*: CORE System Trust & CORE Information Management Systems.

Demartini, B., Petrochilos, P., Ricciardi, L., Price, G., Edwards, M. J., & Joyce, E. (2014). The role of alexithymia in the development of functional motor symptoms (conversion disorder). *J Neurol Neurosurg Psychiatry, 85*, 1132-1137. doi:10.1136/jnnp-2013-307203

Esteves, J. E., Wheatley, L., Mayall, C., & Abbey, H. (2013). Emotional processing and its relationship to chronic low back pain: Results from a case-control study. *Manual Therapy, 18*(6), 541-546. doi:10.1016/j.math.2013.05.008

Field, A. P. (2013). *Discovering statistics using IBM SPSS : and sex and drugs and rock & roll* (4th ed.). London: London : SAGE.

Gratz, K. L., & Roemer, L. (2004). Multidimensional assessment of emotion regulation and dysregulation: Development, factor structure, and initial validation of the difficulties in emotion regulation scale. *Journal of Psychopathology and Behavioral Assessment, 26*(1), 41-54. doi:10.1023/b:joba.0000007455.08539.94

Hobson, R. F. (1985). *Forms of Feeling, The Heart of Psychotherapy*: Tavistock Publications Ltd.

Howlett, S., Grunewald, R. A., Khan, A., & Reuber, M. (2007). Engagement in psychological treatment for functional neurological symptoms--Barriers and solutions. *Psychotherapy (Chic), 44*(3), 354-360. doi:10.1037/0033-3204.44.3.354

Howlett, S., & Reuber, M. (2009). An augmented model of brief psychodynamic interpersonal therapy for patients with nonepileptic seizures. *Psychotherapy (Chic), 46*(1), 125-138. doi:10.1037/a0015138

IBM Corp. (2013). IBM SPSS Statistics for Windows (Version 22.0). Armonk, NY: IBM Corp.

Kret, M. E., & Ploeger, A. (2015). Emotion processing deficits: a liability spectrum providing insight into comorbidity of mental disorders. *Neurosci Biobehav Rev, 52*, 153-171. doi:10.1016/j.neubiorev.2015.02.011

Kroenke, K., Spitzer, R. L., & Williams, J. B. (2002). The PHQ-15: validity of a new measure for evaluating the severity of somatic symptoms. *Psychosom Med, 64*(2), 258-266.

Mayor, R., Howlett, S., Grunewald, R., & Reuber, M. (2010). Long- term outcome of brief augmented psychodynamic interpersonal therapy for psychogenic nonepileptic seizures: Seizure control and health care utilization. *Epilepsia, 51*(7), 1169-1176. doi:10.1111/j.1528-1167.2010.02656.x

Novakova, B., Howlett, S., Baker, R., & Reuber, M. (2015). Emotion processing and psychogenic non-epileptic seizures: A cross-sectional comparison of patients and healthy controls. *Seizure, 29*, 4-10. doi:10.1016/j.seizure.2015.03.007.

Rachman, S. (1980). Emotional processing. *Behav Res Ther, 18*(1), 51-60.

Reuber, M., Burness, C., Howlett, S., Brazier, J., & Grunewald, R. (2007). Tailored psychotherapy for patients with functional neurological symptoms: a pilot study. *J Psychosom Res, 63*(6), 625-632. doi:10.1016/j.jpsychores.2007.06.013

Reuber, M., Howlett, S., Khan, A., & Grunewald, R. A. (2007). Non-epileptic seizures and other functional neurological symptoms: predisposing, precipitating, and perpetuating factors. *Psychosomatics, 48*(3), 230-238. doi:10.1176/appi.psy.48.3.230.

Ricciardi, L., Demartini, B., Crucianelli, L., Krahe, C., Edwards, M. J., & Fotopoulou, A. (2015). Interoceptive awareness in patients with functional neurological symptoms. *Biol Psychol*. doi:10.1016/j.biopsycho.2015.10.009

Roberts, N. A., & Reuber, M. (2014). Alterations of consciousness in psychogenic nonepileptic seizures: emotion, emotion regulation and dissociation. *Epilepsy Behav, 30*, 43-49. doi:10.1016/j.yebeh.2013.09.035

Rothschild, B. (2000). *The Body Remembers- the psychphysiology of trauma and trauma treatment.* New York: W.W. Norton.

Sattel, H., Lahmann, C., Gundel, H., Guthrie, E., Kruse, J., Noll-Hussong, M., . . . Henningsen, P. (2012). Brief psychodynamic interpersonal psychotherapy for patients

with multisomatoform disorder: randomised controlled trial. *Br J Psychiatry, 200*(1), 60-67. doi:10.1192/bjp.bp.111.093526

Sharpe, M., Stone, J., Hibberd, C., Warlow, C., Duncan, R., Coleman, R., . . . Carson, A. J. (2010). Neurology out-patients with symptoms unexplained by disease: illness beliefs and financial benefits predict 1-year outcome. *Psychol Med, 40*(4), 689-698. doi:10.1017/s0033291709990717

Stone, J. (2013). Functional neurological symptoms. *Clinical Medicine, 13*(1), 80-83.

Urbanek, M., Harvey, M., McGowan, J., & Agrawal, N. (2014). Regulation of emotions in psychogenic nonepileptic seizures. *Epilepsy Behav, 37*, 110-115. doi:10.1016/j.yebeh.2014.06.004

Ware, J. E., Kosinski, M., & Gandek, B. (2000). *SF- 36 health survey: manual & interpretation guide*. Lincoln, RI: Quality Metric Incorporated.

World Health Organization. (2016). ICD-10 Version: 2016. Retrieved from http://apps.who.int/classifications/icd10/browse/2016/en#

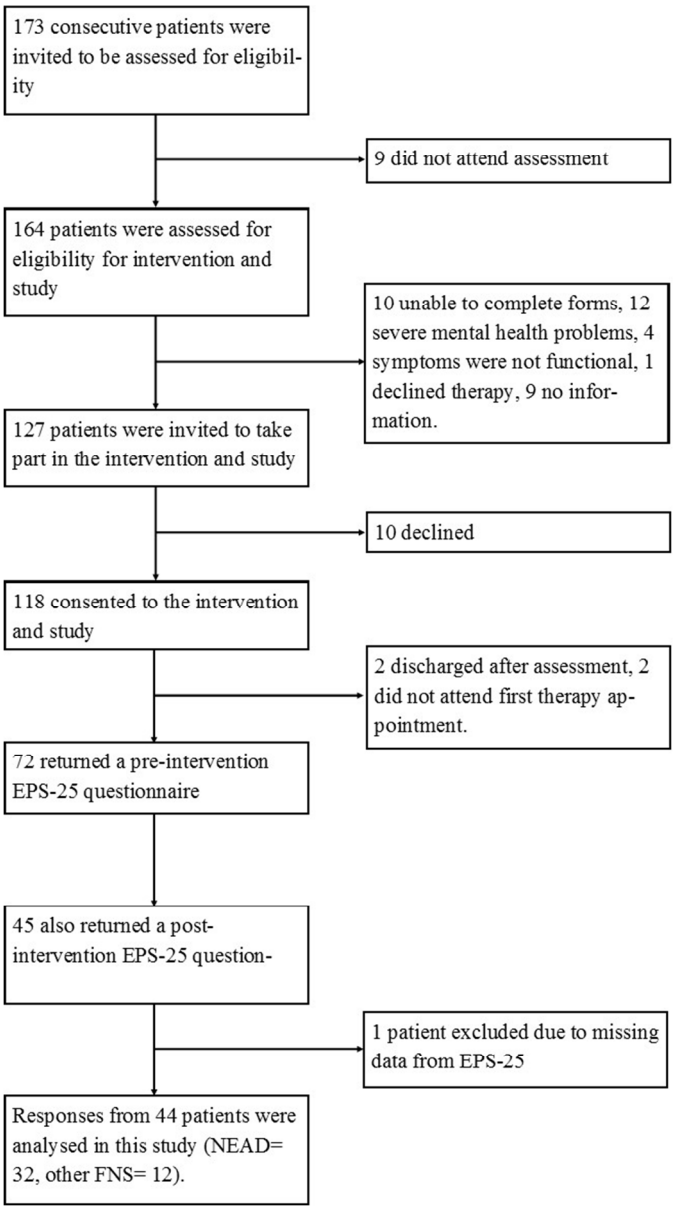

Figure 1 – Flowchart of patient attrition

110x197mm (150 x 150 DPI)

Table 1

Pre- and post-intervention EPS-25 total and subscale scores.

	Pre-intervention		Post-intervention	
EPS-25 scores	*M*	*SD*	*M*	*SD*
Suppression	5.43	2.58	4.69	2.83
Unprocessed emotion	5.56	2.86	4.72	2.73
Unregulated emotion	4.40	2.34	4.10	2.38
Avoidance	5.07	2.29	4.53	2.28
Impoverished emotional experience	4.33	2.64	3.64	2.55
Total	4.96	2.26	4.33	2.31

Note. EPS-25 = Emotion Processing Scale-25. $N = 44$.

Table 2

Bootstrapped Pearson's Correlations (r - values) between pre- and post-intervention questionnaire change scores.

Measure	EPS-25	PHQ-15	CORE-10	BIPQ	MHS	PHS
EPS-25	-					
PHQ-15	.467	-				
CORE-10	.673*	.282	-			
BIPQ	.160	.199	.024	-		
MHS	.634*	.342	.331	.313	-	
PHS	.167	.461	-.122	.307	-.010	-

Note. *significant at adjusted *p* value (p<.008) using the Holm-Bonferroni correction. CORE-10 = Core Outcome in Routine Evaluation-10, BIPQ= Brief Illness Perceptions Questionnaire, PHQ-15= Patient Health Questionnaire- 15, MHS= SF-36 Mental Health Summary Scale, PHS= SF-36 Physical Health Summary Scale

Table 3

Comparison of patients who completed the study and those who did not complete the study on baseline emotion processing and clinical symptomology measures.

	Completers		Non-completers					95% CI	
Measure	*M*	*SD*	*M*	*SD*	*df*	t	*p*	*LL*	*UL*
EPS-25	4.96	2.64	5.10	1.92	75	.18	.84	-.76	1.04
PHS	36.24	11.45	37.25	10.84	68	.38	.71	-.43	6.10
MHS	40.10	10.11	35.48	12.80	68	1.70	.31	-10.46	1.26
CORE-10	19.20	9.40	19.50	10.40	75	.14	.09	-3.80	5.30
PHQ-15	12.80	5.60	14.30	4.90	45	.96	.360	-1.52	4.49
BIPQ	56.10	11.10	48.70	10.30	54	2.52	.02	-12.78	-.074

Note. *significant at adjusted p - value ($p <$. 008) using the Holm-Bonferroni correction. Completers = patients who completed the study. Non-completers = patients who did not complete the study CI = Bootstrapped confidence interval; LL = lower limit; UL = upper limit.. EPS-25 = Emotion Processing Scale-25 Total Score, CORE-10 = Core Outcome in Routine Evaluation-10, BIPQ = Brief Illness Perceptions Questionnaire, PHQ-15 = Patient Health Questionnaire- 15, MHS = SF-36 Mental Health Summary Scale, PHS = SF-36 Physical Health Summary Scale.

Supplementary Table 1

Comparisons of demographic and therapy characteristics between patients with NEAD (n = 32) and patients with 'other FNS' (n = 12).

Characteristics	NEAD	Other FNS	Statistic
Female (%)	77.4	76.9	$\chi^2(1) = .001$, $p = .979$
Mean age at start of therapy (*SD*)	40.42 (14.55)	44.32 (10.12)	$t(42) = -.-.853$, $p = .398$
Economically active (%)	67.7	53.8	$\chi^2(1) = .764$, $p = .382$
Mean sessions (*SD*)	10.90 (11.05)	14.42 (10.48)	$t(41) = -.948$, $p = .349$
Completed therapy (%)	56.7	69.2	$\chi^2(1) = .599$, $p = .439$

Note. NEAD = Nonepileptic Attack Disorder, Other FNS = hemiparesis, jerking, memory problems, dizziness. Mean sessions = number of sessions received by patients.

Supplementary table 2

Comparison of emotion processing and outcome measure scale scores from patients who completed therapy (completers) versus those who did not complete therapy (non-completers).

	Completers		Non-completers					95% CI	
Measure	*M*	*SD*	*M*	*SD*	*df*	*t*	*p*	*LL*	*UL*
EPS-25	5.33	2.10	4.68	2.28	41	-.96	.36	-2.03	0.66
PHQ-15	13.75	5.35	14.63	5.52	35	.47	.64	-2.78	4.52
CORE 10	19.82	9.20	18.00	9.94	41	-.60	54	-7.96	4.10
BIPQ	53.52	10.50	60.50	11.30	31	1.80	.08	-.38	14.26
MHS	39.72	9.94	40.72	10.70	37	.30	.80	-5.90	7.67
PHS	36.60	11.80	35.88	11.34	37	-.15	.86	-7.44	7.75

Note. *significant at adjusted *p* - value Holm-Bonferroni correction. CI = confidence interval; *LL* = lower limit; *UL* = upper limit. CORE-10 = Core Outcome in Routine Evaluation-10, BIPQ= Brief Illness Perceptions Questionnaire, PHQ-15= Patient Health Questionnaire- 15, MHS= Mental Health Summary Scale, PHS= Physical Health Summary Scale.