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‘Emotional Regulation in Borderline Personality Disorder’

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by

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A. Overview

The portfolio has three parts:

- Part one is a systematic literature review, in which the theoretical, conceptual and empirical literature relating to emotional dysregulation in borderline personality disorder is reviewed.

- Part two is an empirical paper, which explores the nature of emotional dysregulation in borderline personality disorder.

- Part three comprises the appendixes.

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Systematic Literature Review

Empirical Paper

Experimental evidence of emotional dysregulation in borderline personality disorder: a systematic review

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This paper is written in the format ready for submission to Clinical Psychology Review. Please see Appendix 2 for the 'Guide for Authors'.

1. Abstract

This paper reviews the theoretical, conceptual and empirical literature relating to emotional regulation in borderline personality disorder. A number of issues relating to the disorder are discussed, including problems with the categorical system of diagnosis and potential co-morbidity. The prominent models of treatment are reviewed along with the evidence for their effectiveness. The concept of a core dysregulation of emotion in the disorder is considered and the psychological models of emotion explored. A systematic review is then described that identified twenty-one experimental studies that investigated aspects of emotional dysregulation in the disorder. The results of this review are categorised into subgroups on the basis of the experimental methods used, and discussed within this context. The results provide limited support for the concept of emotional sensitivity, with empirical evidence for increased attention to emotional stimuli but no evidence of a lower threshold of emotional response. Increased emotional intensity has been demonstrated with self-report and time-sampling data, however results from physiological measures are inconsistent. The limitations of the current literature are discussed, and the implications for future research and clinical practice are considered.

2. Introduction

a. Borderline Personality Disorder

Historically the term ‘borderline’ was used in the psychodynamic literature by Stern (1938) to describe a group of patients who presented with a pattern of difficulties that did not seem to correspond with the traditional concept of ‘neurotic’ and ‘psychotic’ patients. This group were of particular relevance as it was observed that they tended not to benefit from analytic therapy. The term ‘borderline’ intended to describe the fact that this group did not fit into the standard diagnostic categories despite their highly impaired functioning. There have been many changes to the classification and symptomology of the disorder in the literature over the years (Stone, 1980) but despite criticism about its ambiguity (Higgitt & Fonagy, 1992) the term ‘borderline’ has remained.

Borderline personality disorder (BPD) is thought to be prevalent in 1-2% of the general population (Torgersen, Kringlen & Cramer, 2001). The current diagnostic criteria for borderline personality disorder (BPD) are listed on Axis II of the Diagnostic and Statistical Manual of Mental Disorders – 4th Edition (DSM-IV; American Psychiatric Association (APA), 1994) in Cluster B, which are often described as the emotional or erratic disorders. It is defined as, "a pervasive pattern of instability of interpersonal relationships, self-image and affects, as well as marked impulsivity, beginning by early adulthood and present in a variety of contexts," (APA, 1994). To fulfil the diagnostic criteria for BPD, an individual is required to meet at least five of the following nine criteria: a history of frantic

attempts to avoid abandonment; a pattern of unstable and intense relationships; identity disturbance; impulsivity with potentially damaging consequences in at least two areas; persistent suicidal behaviour, gestures or threats; emotional instability; chronic feelings of emptiness; intense or poorly controlled anger; and stress-related paranoid ideation or dissociative symptoms.

The issue of the diagnostic threshold employed by the DSM-IV is worthy of consideration. It can be seen for example that two individuals who reach the diagnostic threshold for BPD by matching five criteria may share only one of the nine possible criteria. Furthermore, the categorical nature of defining the disorder as either present or absent does not correspond with the wider literature on personality (e.g. Costa & McCrae, 1990; Millon, 1996), which uses a dimensional system of classification. This has led some reviewers to question the convergent and discriminate validity of a categorical system of diagnosis (Clark, Livesley & Morey, 1997). It has been shown that within a group of people with a BPD diagnosis those who met more diagnostic criteria were more likely to self-harm and meet the criteria for other Axis II disorders (Asnaani, Chelminski, Young & Zimmerman, 2007). Although attempts have been made to define Axis II disorders in dimensional terms (e.g. Saulsman & Page, 2004) the heterogeneity of the BPD diagnosis has clear implications for the research in the field.

There is also an issue about the potential overlap between BPD and Axis I disorders. It has been noted that people with BPD often present with acute mood disorders that are secondary to the underlying symptomology (Layden,

Newman, Freeman & Morse, 1993). It has been shown that a high proportion of people with BPD have a history of childhood abuse (e.g. Weaver & Clum, 1993) and the suggestion made that BPD may be a complex form of post-traumatic stress disorder (PTSD; Herman & van der Kolk, 1987). There is no empirical evidence to support a causal relationship between childhood trauma and BPD however, and although it may be a contributing factor, people with BPD do not consistently meet the diagnostic criteria for PTSD (Arntz, 1999). Nevertheless the issue of co-morbidity is an important consideration when reviewing the literature in the field.

b. Models of Treatment

BPD presents a significant challenge to mental health services. One study has shown that people with BPD are severely impaired in global measures of functioning even when receiving pharmacological and psychosocial intervention (Skodol, Gunderson, McGlashan, Dyck, Stout, Bender, Grilo, Shea, Zanarini, Morey, Sanislow & Oldham, 2002), and the suicide rate of people diagnosed with BPD may be as high as 8% (Paris, 1987). The value of a psychological model that leads to effective treatment strategies can therefore not be understated.

There has been some empirical evidence for the effectiveness of a psychotherapy treatment, based on the concepts of attachment and including partial hospitalisation (Bateman & Fonagy, 1999, 2001). The cognitive-behavioural model has recently been applied to BPD (Layden *et al*, 1993). One

study has provided evidence that cognitive-behavioural therapy led to fewer suicidal acts and hospital admissions and a higher level of functioning over a two-year period when compared to treatment as usual (Davidson, Norrie, Tyrer, Gumley, Tata, Murray & Palmer, 2006). Schema therapy has also been applied to BPD, emphasising the need to restructure maladaptive schemas developed during childhood (Young, 1990). This approach was found to be more effective than 'transference-based psychotherapy' (TBP) in one study (Giesen-Bloo, van Dyck, Spinhoven, van Tilburg, Dirksen, van Asselt, Kremers, Nadort & Arntz, 2006) although therapist adherence to the TBP model in the comparison group and the lack of a control group in the study has been questioned (Yeomans, 2007; Pearce, 2007). There is also some preliminary evidence that suggests that interpersonal therapy (IPT) is as effective as a cognitive approach for treating depression in people with BPD (Bellino, Zizza, Rinaldi & Bogetto, 2007) although this is yet to be replicated.

The most prominent and widely researched treatment for BPD however is dialectical behaviour therapy (DBT). This treatment approach was developed by Linehan (1993a) following extensive work with people with parasuicidal behaviours. The efficacy of DBT has been investigated in a number of well-controlled research studies (Bohus, Haaf, Simms, Limberger, Schmahl, Unckel, Lieb & Linehan, 2004) and there is strong empirical evidence for its effectiveness for people with BPD (e.g. Koons, Robins, Tweed, Lynch, Gonzalez, Morse, Bishop, Butterfield & Bastian, 2001; Verheul, van den Bosch, Koeter, De Ridder, Stijnen & van den Brink, 2003; van den Bosch, Verheul, Schippers & van den Brink, 2002). The approach emphasises the role of

‘dialectical dilemmas’ and the need to address the polarisation this can lead to within treatment. Individual therapy is provided in addition to skill training groups that develop mindfulness, interpersonal effectiveness, emotional modulation and distress tolerance skills. There is also a particular emphasis on the characteristics of the therapeutic relationship, with therapist support and consultation considered essential.

The DBT approach to treatment is based on the biosocial model of BPD (Linehan, 1993b). This model attempts to explain the development of BPD and the mechanisms underlying its symptomology. The model proposes that a core dysregulation of emotion is caused by a complex interaction between genetic, developmental and environmental factors and maintained by an ‘invalidating environment’ in which thoughts, experiences and behaviours are dismissed, punished or attributed to socially unacceptable characteristics of the individual (Robins, Ivanoff & Linehan, 2001). The other symptoms of BPD, such as impulsivity, intense anger and self-defeating behaviour (e.g. self harm) are seen as attempts to modulate emotional reactions, which are reinforced by a temporary reduction in the intensity of the emotion. Linehan proposed that the symptoms of BPD can all be seen as dysregulation, clustered into five broad domains. Thus the DSM-IV criteria for BPD (APA, 1994) are summarised as dysregulation of emotion (leading to affective instability), behaviour (manifesting as impulsivity and self harm), cognition (in the form of paranoid ideation & dissociation), interpersonal relationships (through efforts to avoid real or imaginary abandonment) and self regulation (due to an unstable self image and chronic feelings of emptiness). The model proposes that dysregulation in the

emotional domain is the core mechanism of BPD that underlies dysregulation in the other domains. In order to consider the implications of this theoretical model thoroughly it is first important to be clear about the concept of emotional dysregulation.

c. Emotional Regulation

In the broadest sense the psychological construct of 'emotion' is defined by the Oxford English Dictionary as, "a mental 'feeling' or 'affection' … as distinguished from cognitive or volitional states of consciousness," (def. 4.b; Simpson & Weiner, 1989). This definition is interesting in that it appears to define emotion in terms of mental processes it is distinct from, as opposed to offering a clear perspective of what it constitutes. Indeed some researchers have argued extensively within the psychological literature that emotion should be seen as distinct from a subjective 'feeling' (e.g. Damasio, 2003) or longer lasting 'mood' (e.g. Ekman, 1992; Watson, 2000), yet there is often an overlap between these terms. This lack of consistency in the literature can make it difficult to be sure about what each investigator is assessing (Rottenberg, 2007).

A useful definition is proposed by the 'two-factor' theory of emotion (Bradley, Codispoti, Cuthbery & Lang, 2001). This suggests that an emotional reaction can be conceptualised as an interaction between the relative intensity of the reaction and its hedonic valence, as measured on a continuum from unpleasant to pleasant. Underlying this perspective is the supposition that the mechanisms of emotion have evolved to mediate two motivational systems, defensive and

appetitive, which act to facilitate survival. The model emphasises two points that are central to a clear definition of emotion. Emotion occurs in relation to a stimulus, either internal or external, that has some significance to the perceiver. Secondly, the function of emotion is to promote a behavioural response to relevant stimuli, whether that is approach or defence. This process clearly implies the interactive contribution of many other factors during an emotional response, such as prior experience, cognitive appraisal processes and underlying physiology (Sloan & Kring, 2007). However, when considered in isolation an emotion can be defined functionally as a short-lasting reaction in response to relevant stimuli that motivates a behavioural response to the stimuli.

The concept of emotional regulation raises a number of further issues. To extend the functional definition of emotion, the purpose of a regulation system can be seen as modifying emotional reactions to impact the proceeding changes in behavioural, physiological and cognitive systems to ensure an individual is able to respond flexibly to emotive stimuli. However, there is a debate in the literature about the mechanism of this regulation. Campos, Frankel & Camras (2004) argue that the mechanisms of emotional regulation should not be considered separate from the processes that generate an emotional response. Thus they view emotional reaction and regulation as simultaneous and interactive processes. Gross (1999), on the other hand, views emotional regulation as a separate and purposeful process that consists of a number of discrete regulatory mechanisms, which are proposed to fall into two categories. Antecedent-focused regulation attempts to modify the saliency of the emotive stimuli with strategies such as environmental control, altering attentional focus

or modifying the cognitive appraisal of a stimulus. Conversely, response-focused regulation attempts to modify the emotional reaction by influencing behavioural and physiological responses, with strategies such as relaxation or self-harm, or the use of substances or medication.

Linehan's (1993b) definition of emotional dysregulation in BPD is perhaps most useful in clinical practice and it encompasses concepts from both perspectives of emotional regulation. Emotional dysregulation is defined as a high sensitivity to emotional stimuli, a high intensity of response to the stimuli and a slow return to baseline once this response has been evoked. This dysregulation is considered the core mechanism of BPD, with the other symptoms seen as subsequent attempts to modulate emotional responses. Linehan (1993b) describes 'high sensitivity' as an increased level of attention and low threshold of responding to emotionally-relevant stimuli. Hence, increased sensitivity may be demonstrated by both an increased awareness of emotional stimuli and emotional responses to stimuli that would not provoke a reaction in an individual without BPD. The term 'emotional intensity' refers to an exaggerated emotional reaction to relevant stimuli in individuals with BPD. Finally a 'slow return to baseline' refers to increased longevity of the emotional response. It should be noted that, by definition, emotional responses are short-lasting. However, Linehan (1993b) argues that the response of the cognitive, behavioural and physiological systems to the initial reaction reactivates the emotional response in a cyclic fashion. Linehan (1993b) acknowledges that these differences may be more pronounced in negative emotions, but suggests that dysregulation occurs for all emotions irrespective of their hedonic valence. This model of

emotional dysregulation provides a framework within which differences in people with BPD can be researched and investigated. The current literature review will identify and consider the experimental evidence for the biosocial model.

3. Method

a. Data sources and search strategy

A systematic literature review was undertaken to identify relevant studies. This was initially conducted using two internet databases: PsychINFO and MEDLINE. The search used the following keywords as search criteria: [BORDERLINE PERSONALITY DISORDER] with [AFFECT] or [AFFECTIVE] or [EMOTION] or [EMOTIONAL], and [REGULATION] or [DYSREGULATION] or [CONTROL]. The online abstracts identified by this search were reviewed for potentially relevant articles and full copies of these articles were then obtained. The reference lists of the full articles were then inspected manually by the reviewer for additional relevant studies. The abstracts of additional studies identified were subsequently reviewed on PsychINFO and full copies were obtained when relevant.

b. Data Extraction

The articles were assessed by the reviewer. A structured pro-forma was used to assess eligibility and record the relevant details of each study. Exclusion criteria were: 1) review article with no original data; 2) no measure of emotional

regulation as defined by the biosocial model; and 3) neurobiological data only. The final exclusion criterion was included as the increasing number of studies mapping the neural correlates of emotional regulation are not directly compatible with the psychological model being investigated and so considered beyond the scope of this review. Readers are directed to Brendel, Stern & Silbersweig (2005) for a thorough review of this literature.

The article selection procedure is represented diagrammatically in Figure 1.

Figure 1: A flowchart of the article selection process

The electronic search identified 37 relevant articles and the manual reference list search identified a further 10 articles. A total of 47 articles were assessed by the reviewer. Seven review articles were excluded and a further ten articles were excluded for containing only neurobiological data. Nine of the articles with experimental data were excluded as they did not contain a measure of emotional regulation that corresponded with the definition provided by the biosocial model. The excluded articles are shown in Table 2. Twenty-one articles met inclusion criteria in total. However, two of these articles (Herpertz, Kunert, Schwenger & Sass, 1999; Herpertz, Schwenger, Kunert, Lukas, Gretzer, Nutzmann, 2000) report the same data and only the more recent article is discussed in the review.

Table 1: Exclusion criteria and excluded articles

4. Results

The articles were classified into three groups on the basis of the aspect of emotion regulation they investigated; sensitivity to emotional stimuli, increased emotional intensity, or with a dimensional approach. Two papers contained a measure of sensitivity and emotional intensity (Levine, Marziali & Hood, 1997; Bland, Williams, Scharer & Manning, 2004) and were included in both groups. The three groups of articles will be discussed in order.

a. Sensitivity to emotional stimuli

Eight of the articles included some measure of sensitivity to emotional stimuli as defined in the biosocial model and are summarised in Table 2.

Table 2: Studies investigating sensitivity to emotional stimuli

i. Emotional Stroop task

A number of studies have used a variation of the Stroop task to investigate hypervigilance to emotional stimuli in people with BPD. This task requires the participant to name the font colour of a visually presented word as quickly as possible. Response times for naming the font colour consistently increase when the word is emotionally salient when compared to neutral words. This is thought to be the result of the allocation of attentional resources to the emotional stimuli. Thus it was hypothesised that people with BPD would demonstrate greater

response times on the task for emotional words due to increased sensitivity to the stimuli. This has received only limited support from experimental studies. Arntz, Appels & Sieswerda (2000) demonstrated a significantly greater response time for a number of categories of negative words when people with BPD were compared to controls. These results were interpreted as evidence for hypervigilance to negative emotional stimuli as proposed by the biosocial model. However, this difference was also significant in a sample of people with Cluster C personality disorders, and there was no significant difference between this sample and the BPD group. Sprock, Rader, Kendall & Yoder (2000) used the emotional Stroop task as part of a wide range of neuropsychological tests. No significant difference was found between a BPD sample, a control group and a sample of people with current Major Depressive Disorder (MDD) for either 'anger' or 'sadness' words. A more recent study carried out by Domes, Winter, Schnell, Vohs, Fast & Herpertz (2006) also failed to find any significant difference on the task for negative or positive words between a BPD sample and a control group. This study benefited from a larger clinical sample than its predecessors. In summary the emotional Stroop task has been used to in three studies to investigate increased sensitivity to negative emotional stimuli in people with BPD, but has provided only limited evidence for such a difference.

iii. Directed Forgetting

The 'directed forgetting' paradigm has also been used to investigate sensitivity to emotional stimuli in people with BPD. In this paradigm participants are presented with lists of words followed by an instruction to either remember or

forget the words. The number of words remembered from the two categories can then be tested with recall and recognition tasks. Participants tend to perform on this task as instructed, thereby remembering more of the 'to be remembered' words and inhibiting recall of the 'to be forgotten' words. It was hypothesised however that people with BPD would demonstrate a bias towards emotionally salient words by increased recall of these words. Korfine & Hooley (2000) demonstrated a bias towards negative words with a 'borderline' association (e.g. 'abandon', 'emptiness') in two samples of people with BPD (one community sample and a sample of people attending a day hospital). This bias was shown by increased free recall of these words when compared to controls in the 'to be forgotten' category only. However, within this category the hospitalised group demonstrated a significantly lower recall of positive emotional words than the other two groups. Similar results were found by Domes *et al* (2006), who demonstrated significantly higher recall of negative words in sample of females with BPD in the 'to be forgotten' category. No difference was found between groups for positive emotional words. Taken together these well-designed studies provide compelling evidence of a greater allocation of attentional resources to negative emotional words in people with BPD, which manifests as a difficulty in suppressing these words in memory.

iii. Recognising facial expressions

The other main area of investigation of emotional sensitivity in BPD involves facial expressions. This is perhaps not surprising given the central role of facial expressions in the interpersonal communication of emotion across cultures

(Ekman, 1992). Levine *et al* (1997) investigated emotion identification in people with BPD using the standard set of Pictures of Facial Affect (PFA; Ekman & Friesen, 1984). They showed subjects the pictures of faces depicting six basic emotions and made them identify each emotion with a multiple choice response. The BPD sample was shown to be significantly less accurate at identifying the emotions depicted by the faces. The study did not however screen for any concurrent Axis I disorders, except for the exclusion criteria of schizophrenia. This result was replicated by Bland *et al* (2004) in a smaller sample of female inpatients with BPD. It is worth noting the psychiatric inpatient status of the sample, and the fact that although Axis I disorders were screened for they do not appear to have been factored into the analysis. Wagner & Linehan (1999) investigated this further using a comparable set of facial expression pictures. Responses were compared between a sample of females with BPD, a control group and sample of females who reported childhood sexual abuse but did not meet diagnostic criteria for BPD. The results of this study were less straightforward. The BPD sample were significantly more accurate than the other groups at identifying fear but less accurate than controls at identifying neutral expressions, as were the childhood sexual abuse sample. There may have been confounds in the sample, such as that the BPD sample were significantly younger than the other groups and all participants in the study were female. The results do however appear to contradict the previous results.

Lynch, Rosenthal, Kosson, Cheavens, Lejuez & Blair (2006) used a computer program to 'morph' a neutral facial expression from the PFA (Ekman & Friesen, 1984) into one of the six basic emotions in a series of steps, with subjects

required to identify the expression as soon as possible. The BPD sample in this study were consistently more accurate at identifying the expressions at an earlier stage than the control group and in post-hoc analyses it was shown that this could not be accounted for by impulsive, inaccurate guessing at an earlier stage. This result contradicts earlier findings, and importantly suggests that the BPD sample are more attentive to the expressions and potentially have a lower threshold for reacting to the emotions depicted, if it is assumed that the cognitive appraisal is directly related to an underlying emotional reaction. This result does however need to be replicated with a larger sample. In summary, it is not yet clear whether people with BPD demonstrate differences in the accuracy of identifying facial expressions, however there is some preliminary evidence that they may be more sensitive to them.

b. Intensity of emotional reaction

Eleven of the articles included a measure of intensity of emotional reaction as defined in the biosocial model and are summarised in Table 3.

Table 3: Studies investigating intensity of emotional reaction

i. Physiological measures

An important area of investigation into the intensity of emotional reaction in people with BPD comes from studies that have attempted to measure the underlying physiology of these reactions. Herpertz *et al* (2000) used a set of

emotional pictures taken from the International Affective Picture System (IAPS; Lang, Bradley & Cuthbert, 2005). The IAPS is a large database of photographs with standardised data to indicate the hedonic valence and emotional intensity of each picture as rated by a large, non-clinical sample. Herpertz *et al* (2000) used stimuli from the IAPS grouped into three conditions: negative, positive and neutral. Participants were required to rate the hedonic valence and relative intensity of each picture on a sliding scale as a number of physiological measures were taken. Skin conductance and heart rate were recorded as objective measures of increased emotional response. An acoustic probe was also used to elicit a startle response as measured by eye-blink reaction. This has been shown to be modulated by emotional state, increasing in the context of negative emotions and reducing in the context of positive emotions. The results failed to find a significant difference in startle response between a BPD sample, control group and a sample of people meeting the criteria for Antisocial Personality Disorder but not BPD. Furthermore, the BPD sample had a significantly lower skin conductance to the emotional stimuli, and heart rate deceleration to the pleasant pictures. This pattern of results suggested under-arousal to the emotional stimuli, in contradiction to the biosocial theory of BPD.

A more recent study (Hazlett, Speiser, Goodman, Roy, Carrizal, Wynn, Williams, Romero, Minzenberg, Siever & New, 2007) recorded the same physiological measures with a different mood induction procedure. Participants viewed emotionally salient words on a screen and were asked to read them silently and think about their meaning. The BPD sample was carefully selected using a wide range of exclusion criteria, with concurrent Axis I disorders controlled for in the

analyses. The results indicated a significantly greater startle response in the BPD group when words with negative connotations were being considered. This suggests that the negative emotional reaction was potentiating the effect and was taken as evidence of increased intensity of response to emotional stimuli in BPD.

Both of the previous studies were well designed with carefully selected, adequately sized samples so it is difficult to reconcile the contradictory findings. Although the emotional stimuli used were dissimilar, the validity of neither is in doubt. Ebner-Priemer, Badeck, Beckmann, Wagner, Feige, Weiss, Lieb & Bohus (2005) played unpredictable, startling tones to participants in the absence of any emotional stimuli. This task was used to investigate the physiological pathway of the fear response, which it was hypothesised would be overactive in a sample of females with BPD. The results indicated such a difference with a significantly greater startle response in the BPD sample when compared to controls. Interestingly, the study also used a measure of state dissociation, which was found in the analysis to be a significant covariate. Despite the small size of the BPD sample (N=18), when the BPD group was split along the median score on this measure into two subgroups the difference in startle response between the groups almost reached significance. This result requires further investigation with a larger sample.

A further physiological measure of emotional intensity was used in a study was carried out by Renneberg, Heyn, Gebhard & Bachmann (2005). The study used the Facial Action Coding System (FACS; Ekman & Friessen, 1978), which

provides an objective scoring system of emotional facial expressions and has previously been used as a physiological measure of emotion in people with depression. The study used two short films to evoke positive and negative emotion. A sample of people with BPD were compared to a control group and a group of people meeting the diagnostic criteria for MDD. The pattern of response in the BPD sample matched that of the MDD group, which was interpreted as an indicator of low intensity emotional responses in the sample. It should be noted however that there was a high concordance of MDD in the BPD sample which does not appear to have be controlled in the analyses.

ii. Time-sampling studies

Stein (1996) reported the results of an interesting study in which the emotional experience of a small sample of people with BPD was recorded over a period of 10 days. Participants were signalled 50 times over this time period and asked to rate the extent to which a list of 48 adjectives matched their current emotional state. These adjectives were based on the two-factor theory of emotion (Bradley *et al*, 2001), and reflected eight different combinations of the intensity versus hedonic valence interaction (e.g. intense negative, non-intense positive, etc.). The study aimed to look at emotional lability over time and did not measure intensity directly, yet did provide some measure of the extent to which each discreet emotional category was endorsed. The results indicated that the BPD sample and also a sample of people with Anorexia reported a greater level of negative emotional experience of above average intensity over the time period. There are a number of limitations to the study, most notably the small sample

size and the complicated mode of assessment that may affect the validity of the self-report data. This time-sampling procedure has however been employed by two subsequent studies.

Russell, Moskowitz, Zuroff, Sookman & Paris (2007) extended the time-sampling method to compare a BPD sample to a control group over a 20 day period. Participants were asked to record interpersonal encounters on a structured event recording form, which documented behaviour and emotional reactions during each encounter. Participants were again asked to rate the intensity of emotion in terms of nine adjectives that represented the range hedonic valence. The results indicated that BPD reported a higher intensity of negative emotions, but that this difference was not present for positive emotions. The authors suggested that this might be accounted for by high frequency of negative emotions reported by the BPD group. The study used large samples but did not measure concordant Axis I disorders. It should also be noted that the study looked specifically at emotions during interpersonal encounters and, as noted by the authors, that differences in the nature of the relationships of people with BPD may be a confound. This was addressed in a study by Ebner-Priemer, Welch, Grossman, Reisch, Linehan & Bohus (2007), which assessed emotion at random intervals over a 24 hour period. Participants were required to select a word that most closely matched their current emotion and then to rate its intensity. This seems a less complicated and more naturalistic mode of assessment, which yielded the same result of a greater frequency and higher intensity of negative emotions in the BPD sample. The study also measured 'additional heart rate' in participants, which was defined as an increase of more

than 3 beats per minute without an increase in activity. The BPD sample showed a greater frequency of this heart rate acceleration which was interpreted as a further physiological indicator of greater emotional intensity.

iii. Self-report questionnaires

A number of studies have measured intensity of emotional reactions with the self-report Affect Intensity Measure (AIM; Larsen & Diener, 1987). The AIM is a 40-item questionnaire based on the work of Larsen & Diener (1987) which conceptualises emotional intensity as a stable personality trait. The AIM assesses the typical intensity of respondents emotional reactions as rated by scaled responses to real life situations. The items include responses to both negative and positive emotionally salient situations and the test-retest reliability, convergent and discriminate validity have all been established for the measure (Larsen & Diener, 1987).

Bland *et al* (2004) found that a large sample of female, psychiatric inpatients with BPD rated their emotional intensity significantly higher than a control group on the AIM (Larsen & Diener, 1987). However, as previously noted, there may be issues of generalisabilty with an inpatient sample and the possible covariate of concurrent mood disorders was not factored into the analysis. Levine *et al* (1997) found the same difference between a BPD sample and a control group when administering only the negative items of the AIM (Larsen & Diener, 1987), however again no information was recorded about concordant Axis I disorders. Hazlett *et al* (2007) also used the AIM (Larsen & Diener, 1987) and reported

significantly higher scores in their BPD sample, from which anyone with a concordant Axis I other than an anxiety disorder was excluded. This arguably remains the most compelling evidence of increased intensity of emotions by this self-report questionnaire.

The AIM (Larsen & Diener, 1987) has also been used to compare the emotional intensity of people with BPD to other clinical groups. Koenigsberg, Harvey, Mitropoulou, Schmeidler, New, Goodman, Silverman, Serby, Schopick & Siever (2002) recruited a large mixed-sex sample of people who met the diagnostic criteria for any Axis II disorder. They found that within this sample the people who met the diagnostic threshold for BPD reported greater intensity of emotion on the AIM (Larsen & Diener, 1987) than people without BPD, even when concurrent Axis I disorders were controlled for. Henry, Mitropoulou, New, Koenigsberg, Silverman & Siever (2001) however did not find a significant group effect on AIM (Larsen & Diener, 1987) score when comparing BPD to Bipolar Disorder, either with or without BPD. In summary, there is currently limited support for increased intensity of emotional reaction from self-report measures.

c. Correlational studies/Dimensional approach

The remaining three articles investigated aspects of emotional regulation using a dimensional approach, which warrants separate consideration. These articles (Yen, Zlotnick & Costello, 2002; Rosenthal, Cheavens, Lejuez & Lynch, 2005; Rosenthal, Cukrowicz, Cheavens & Lynch, 2006) assessed the relationship between specific measures of emotion regulation and BPD symptomology. The

studies are comparable in using no diagnostic cut-off for the presence of BPD in regression analyses and thus conceptualising the disorder as a continuum.

Yen *et al* (2002) reported that two self report measures of emotion regulation predicted the number of BPD diagnostic criteria met in an inpatient sample of females. With reference to the biosocial theory of emotional dysregulation they administered the AIM questionnaire (Larsen & Diener, 1987) to assess emotional intensity and another self-report measure (Affective Control Scale; Williams, Chambless & Ahrens, 1997) to measure perceived emotional control. Higher reported intensity of emotion and lower perceived control were found to be independently associated with more BPD criteria, even when a measure of current depression was controlled for. Although this was a correlational analysis the majority of the participants in the study met the criteria for BPD. However, concordant Axis I disorders were not accounted for.

An adapted, shorter version of the AIM (Larsen & Diener, 1987) was used within regression analyses in two related studies (Rosenthal *et al*, 2005; Rosenthal *et al*, 2006) investigating the use of cognitive strategies by people with BPD. Twelve items were selected from the AIM (Larsen & Diener, 1987) to provide a self-report measure of negative emotional intensity. Rosenthal *et al* (2005) found that this measure was a better predictor of number of BPD symptoms in a large community sample than a measure of childhood trauma. However, subsequent analyses indicated that this relationship was mediated by the degree of use of thought suppression as a cognitive strategy. Rosenthal *et al* (2006) used the same AIM (Larsen & Diener, 1987) items in a regression analysis and showed it

to be a significant predictor of number of BPD symptoms, and that this association was not mediated by self-punishment strategies as hypothesised.

5. Discussion

The aim of this review was to examine the empirical support for the psychological model of emotional dysregulation proposed by the biosocial theory of BPD (Linehan, 1993b). A range of experimental studies that investigated aspects of this model were identified and within them a number of different experimental paradigms were used. The studies generally provide good support for the model, however there are some notable discrepancies in the results.

Experimental studies that investigate sensitivity to emotional stimuli use tasks that detect differences in the allocation of attentional resources to such stimuli. Both the emotional Stroop and the directed forgetting paradigms assess sensitivity to words with emotional salience by measuring the extent to which these words interfere with an unrelated task. There is limited empirical support for increased sensitivity in the Stroop task, with two null results reported in the literature. In the directed forgetting paradigm however there is strong support for an increased sensitivity to negative emotional words in people with BPD. Due to the similarity of the two tasks it might be valid to question the sensitivity of the Stroop task for detecting differences between clinical and non-clinical samples. Future use of the paradigm may require a large sample size to assess this.

The articles investigating emotional sensitivity in BPD do not however provide empirical support for the concept of a lower threshold of emotional response. Linehan (1993b) proposed that such a difference is central to the concept of emotional sensitivity, and although evidence of an increase of attentional resources to emotional stimuli is often interpreted as a manifestation of a lower threshold of response there is no direct evidence to support this view. It is also notable that increased attention has been demonstrated for negative stimuli only. This might suggest that the results are indicative of hypervigilance to negative emotional stimuli in the BPD samples rather than a more general emotional sensitivity. However, it is also worth noting that the experimental paradigms used do not attempt to directly measure threshold of emotional response. Further investigation would require carefully selected stimuli and a highly sensitive measure of emotional reactivity in order to ascertain whether this difference can be demonstrated in people with BPD.

The other prominent method for investigating sensitivity is the measurement of accuracy in identifying facial expressions. Although this limits investigation to emotion in an interpersonal context it is arguably the most salient emotional stimuli in the natural environment. Studies using this paradigm generally appear to suggest that people with BPD are less accurate at identifying facial expressions than controls. However, it is appropriate to consider these studies in the context of the research question they address. The biosocial model (Linehan, 1993b) defines sensitivity as increased attention to emotional stimuli and a lower threshold of response to those stimuli. It is not clear to what extent accuracy of facial expression identification reflects these factors, especially as

the task requires a cognitive evaluation that may not necessarily relate to an underlying emotional reaction. Furthermore as Lynch *et al* (2006) point out most studies measure accuracy at the point of maximum facial expression, which may affect the validity of the task. There is also a notable lack of psychiatric comparison groups in these studies despite evidence to suggest that MDD (Raes, Hermans & Williams, 2006) and schizophrenia (Turetsky, Kohler, Indersmitten, Bhati, Charbonnier & Gur, 2007) can affect accuracy of identifying facial expressions. The empirical result that people with BPD recognise facial expressions at an earlier stage may be more of more relevance to the biosocial model, and may provide support to the concept of a lower threshold of emotional response. Consequently this result would benefit from replication.

Investigation into the intensity of emotional reactions using self-report measures provides good empirical support for a greater intensity of negative emotions in people with BPD. This has been demonstrated in both naturalistic, time-sampling studies and with the use of the AIM questionnaire (Larsen & Diener, 1987). Furthermore, there is evidence that self-reported intensity of negative emotion has a significant and independent positive correlation with the number of BPD criteria met. These studies are cross-sectional in nature and therefore do not infer causal relationships. Nevertheless it is important to consider these findings as they may indicate the psychopathology that underlies the symptoms of BPD that lead to psycho-social difficulties. Taken together, there is an abundance of empirical evidence that people with BPD perceive their negative emotions to be more intense than controls.

The physiological evidence for greater intensity of emotions in people with BPD is less conclusive. One study (Herpertz *et al*, 2000) found no difference in startle response in people with BPD and a decrease in skin conductance that suggested underarousal to emotional stimuli. However, this result has been contradicted by subsequent results that indicated a greater intensity of reaction to negative stimuli with an increased startle response in the BPD sample. A possible explanation for this discrepancy may be provided by the Ebner-Priemer *et al* (2005) study, which included a measure of state dissociation in the analysis. The results suggested that this was an important factor to consider in the BPD sample for in-vivo, emotion induction studies of this type. This might be expected, as stress-related dissociative symptoms are included in the diagnostic criteria for the disorder, and would need to be controlled for carefully. As such it is currently unclear to what extent physiological measures provide empirical support for greater intensity of emotion in BPD.

a. Limitations of current research

The extent of co-morbidity in BPD is widely recognised and a clinical sample with no concurrent Axis I or Axis II disorders is unlikely to be ecologically valid. However, the presence of concurrent disorders is an important consideration when investigating emotional regulation. The diagnostic criteria of PTSD include increased arousal to negative and specifically fearful emotional stimuli, and low mood and frequent, intense negative emotions are characteristic of people diagnosed with MDD. Furthermore, some of the diagnostic criteria of BPD are similar to those of other Axis II disorders (particularly Dependant and Antisocial)

and a high level of concurrent Axis II disorders have been reported (Torgersen *et al*, 2001). Of the twenty-one articles meeting inclusion criteria in this review twelve included diagnostic information about concurrent Axis I disorders and only five included a psychiatric control group. Similarly only three studies included an Axis II comparison group and concordant Axis II disorders in the BPD sample were frequently not included in the data analysis. This represents a major limitation in the current literature in this area. In order to assess the specific role of aspects of emotional dysregulation in BPD concurrent Axis I and Axis II disorders need to be carefully controlled for in the sampling and analysis procedures, and this presents a major challenge for future investigation in this area.

Inspection of the articles included in this review reveals a bias towards female participants, with eleven of the twenty-one studies using only female participants. Data from community samples suggests that BPD may be twice as prevalent in females (Torgersen *et al*, 2001). It is however important for a number of reasons that the proportion of males meeting the diagnostic criteria for BPD should be represented in empirical studies investigating emotion. Female participants have been shown to be more attentive to their emotional reactions (Thayer, Rossy, Ruiz-Padial & Johnsen, 2003) and more accurate at identifying emotional cues in others (Hall & Matsumoto, 2004). Furthermore, in a multi-cultural study females were found to report a lower intensity of 'powerful' emotions, such as anger, and a higher intensity of 'powerless' emotions, such as fear and sadness (Fischer, Rodriguez Mosquera, van Vianen & Manstead, 2004). These significant gender differences in sensitivity to external and internal

emotional stimuli and intensity of emotional reaction have clear implications for tasks that investigate emotional dysregulation. In order to control for these effects it may be important to ensure samples are chosen to more accurately reflect the prevalence of BPD across genders.

A further limitation of the current literature is the emphasis on negative emotions. The biosocial theory (Linehan, 1993b) postulates that although emotional dysregulation may be more pronounced in negative emotions it is present across the full range of emotional experience. There is currently a paucity of empirical support for the concept of a general dysregulation as the emphasis is on negative emotions. This is evident in the fact that the majority of the studies included in the review use negative stimuli but no corresponding positive stimuli. In studies in which positive stimuli are used there is little empirical support for either increased sensitivity or greater intensity of reaction in people with BPD to the stimuli. However, in these studies there is little or no attempt to match the salience of the positive stimuli to make it equivalent to the negative stimuli. This is reflected in the AIM questionnaire (Larsen & Diener, 1987), which uses predominantly negatively valenced items. A further confound can be seen in the time-sampling studies which indicate that people with BPD experience positive emotions less frequently than controls. This may affect the sensitivity of current experimental procedures to detect any potential differences in positive emotional experience in BPD samples. Further investigation with careful consideration of these methodological issues will be needed for the concept of a general emotional dysregulation in BPD to gain empirical support.

b. Conclusions

The current review elucidates the large body of literature investigating aspects of emotional dysregulation as defined by the biosocial model of BPD (Linehan, 1993b). It also raises a number of implications for future research. There is currently strong empirical evidence for an increased sensitivity to negative emotional stimuli in people with BPD. This could be however further supported by data from other experimental paradigms that assess sensitivity to emotional stimuli that are sensitive to potentially subtle differences between BPD and comparison samples. There is also strong support for a greater intensity of negative emotion in self-report data from people with BPD. Additional empirical evidence is however needed to verify whether greater intensity of emotion can be detected by physiological measures, with careful consideration of the effect of dissociative states during such procedures.

A number of additional issues have been raised by this review. Further research in the area is required to investigate whether currently reported differences in the regulation of negative emotions generalise to positive emotional experience. Future research should also be aware of gender differences in emotion processing and control for this in the sampling procedure. Finally, further investigation into the role of emotional regulation in BPD needs to address the issue of concurrent Axis I and Axis II disorders in order to thoroughly assess whether dysregulation in this domain can be directly attributed to the diagnosis of BPD.

Word Count: 7,591

Figure 1: A flowchart of the article selection process

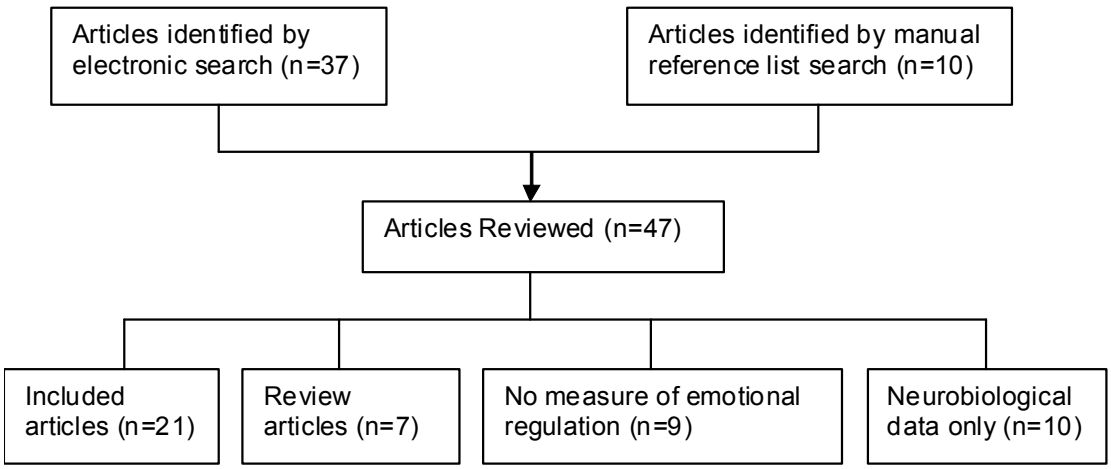

Table 1: Exclusion criteria and excluded articles

Exclusion Criteria	Article
Review Article	Brendel, Stern & Silbersweig (2005)
	Corrigan, Davidson & Heard (2000)
	Harned, Banawan & Lynch (2006)
	Johnson, Hurley, Benkelfat, *et al* (2003)
	Mauchnik, Schmahl & Bohus (2005)
	McMain, Korman & Dimeff (2001)
	Putnam & Silk (2005)
Neurobiological data only	Beblo, Driessen, Mertens, *et al* (2006)
	Donegan, Sanislow, Blumberg, *et al* (2003)
	Driessen, Herrmann, Stahl, *et al* (2000)
	Hazlett, New, Newmark, *et al* (2005)
	Herpertz, Dietrich, Wenning, *et al* (2001)
	Minzenberg, Fan, New, *et al* (2007)
	Schmahl, Vermetten, Elzinga & Bremner (2003)
	Schnell & Herpertz (2007)
	Schnell, Dietrich, Schnitker, *et al* (2007)
	Zetzsche, Frodl, Preuss, *et al* (2006)
No measure of emotional regulation as defined by the biosocial model	Arntz, Klokman & Sieswerda (2005)
	Conklin, Bradley & Westen (2006)
	Gratz, Rosenthal, Tull, *et al* (2006)
	Herpertz, Gretzer, Steinmeyer, *et al* (1997)
	Kurtz & Morey (1998)
	Lieble & Snell (2004)
	Nigg, Silk, Stavro & Miller (2005)
	Veen & Arntz (2000)
	Williams, Sidis, Gordon & Meares (2006)

Table 2: Studies investigating sensitivity to emotional stimuli

Authors	Characteristics of the BPD sample	Comparison Groups	Tasks	Findings
Arntz, Appels & Sieswerda (2000)	▪ N=16 ▪ mean age = 29.8 ▪ 100% female	▪ Normal controls ▪ Cluster C PD group but not BPD	Emotional Stroop task with four conditions: ▪ negative descriptors of others ▪ negative descriptors of oneself ▪ words relating to sexual abuse ▪ non-specific negative words	Significantly slower response time for negative words in all conditions in the BPD sample and the Cluster C sample when compared to the control group.
Sprock, Rader, Kendall & Yoder (2000)	▪ N=18 ▪ mean age = 37.6 (SD = 5.3) ▪ 100% female	▪ Normal controls ▪ Current Major Depressive Disorder (MDD) group	Emotional Stroop task with two conditions: ▪ anger words ▪ sadness words	No significant difference between groups in either condition.
Domes, Winter, Schnell, Vohs, Fast & Herpertz (2006)	▪ N=28 ▪ mean age not reported ▪ 100% female	▪ Normal controls	Emotional Stroop task with non-specific negative words Directed forgetting paradigm with two conditions: ▪ positive words ▪ negative words	No significant difference between groups on Emotional Stroop task. Significantly higher recall of negative words in BPD sample in the 'to be forgotten' category, but no significant difference for positive words.
Korfine & Hooley (2000)	▪ Community sample (N=23, mean age=28.2, SD=7.2, 78% female) ▪ Inpatient sample (N=23, mean age=30.7, SD=6.2, 90% female)	▪ Normal controls	Directed forgetting paradigm with two conditions: ▪ positive words ▪ 'borderline' words (e.g. emptiness)	Significantly higher recall of 'borderline' words in both BPD samples in the 'to be forgotten' category. Significantly lower recall of positive emotional words in the inpatient sample compared to the other two groups.
Levine, Marziali & Hood (1997)	▪ N=30 ▪ mean age = 37.6 (SD = 7.8) ▪ 66% female	▪ Normal controls	Accuracy of identifying facial expressions (happiness, sadness, anger, fear, disgust, surprise and neutral) with multiple choice response	Significantly lower accuracy in the BPD sample.

Authors	Characteristics of the BPD sample	Comparison Groups	Tasks	Findings
Bland, Williams, Scharer & Manning (2004)	▪ N=35 ▪ mean age = 32.3 (SD = 8.5) ▪ 100% female	▪ Normal controls	Accuracy of identifying facial expressions (happiness, sadness, anger, fear, disgust, surprise and neutral) with multiple choice response	Significantly lower accuracy in the BPD sample.
Wagner & Linehan (1999)	▪ N=21 ▪ mean age = 29.7 (SD = 5.9) ▪ 100% female	▪ Normal controls ▪ Self-reported childhood sexual abuse group but not BPD	Accuracy of identifying facial expressions (happiness, sadness, anger, fear, disgust, surprise and neutral) with verbal response	BPD sample significantly more accurate at identifying fear expressions than comparison groups. BPD sample and control group significantly more accurate at identifying happiness expressions than childhood sexual abuse group. BPD sample and childhood sexual abuse group significantly less accurate at identifying neutral expressions than controls.
Lynch, Rosenthal, Kosson, Cheavens, Lejuez & Blair (2006)	▪ N=20 ▪ mean age = 35.5 (SD = 11.2) ▪ 85% female	▪ Normal controls	Speed and accuracy of identifying facial expressions (happiness, sadness, anger, fear, disgust and surprise) with multiple choice response as they 'morph' from a neutral expression	BPD sample significantly more accurate at identifying expressions at an earlier stage than the control group.

Table 3: Studies investigating intensity of emotional reaction

Authors	Characteristics of the BPD sample	Comparison Groups	Tasks	Findings
Herpertz, Schwenger, Kunert, Lukas, Gretzer & Nutzmann (2000)	▪ N=24 ▪ mean age = 28 (SD = 6.1) ▪ 100% female	▪ Normal controls ▪ Antisocial PD group	Viewing emotional images (negative and positive) and physiological measures taken: ▪ Startle response to audio probe ▪ Skin conductance ▪ Heart rate	No significant difference in startle response between groups. Significantly lower skin conductance to emotional stimuli and lower heart rate for positive stimuli in the BPD sample.
Hazlett, Speiser, Goodman, Roy, Carrizal, Wynn, Williams, Romero, Minzenberg, Siever & New (2007)	▪ N=27 ▪ mean age = 31 (SD = 7.8) ▪ 33% female	▪ Normal controls	Thinking about the meaning of visually presented words with negative connotations while physiological measures were taken: ▪ Startle response to audio probe ▪ Skin conductance ▪ Heart rate	Significantly greater startle response in the BPD group when thinking about negative words.
Ebner-Priemer, Badeck, Beckmann, Wagner, Feige, Weiss, Lieb & Bohus (2005)	▪ N=21 ▪ mean age = 28.5 (SD = 8.1) ▪ 100% female	▪ Normal controls	Played startling tones at random intervals and physiological measures taken: ▪ Startle response to audio probe ▪ Skin conductance ▪ Heart rate	Significantly greater startle response in the BPD group. A measure of state dissociation was found to be a significant covariate.
Renneberg, Heyn, Gebhard & Bachmann (2005)	▪ N=30 ▪ mean age = 28.5 (SD = 9.1) ▪ 100% female	▪ Normal controls ▪ Current Major Depressive Disorder (MDD) group	Viewed two short emotional films (negative and positive) and emotional response rated with the Facial Action Coding System (FACS; Ekman & Friessen, 1978)	Emotional reaction as measured by the FACS significantly lower in the BPD and MDD sample and no significant different between these two groups.
Stein (1996)	▪ N=15 ▪ mean age = 27.6 (SD = 5.7) ▪ 80% female	▪ Normal controls ▪ Anorexia group	Participants signalled 50 times over a 10 day period and asked to rate the extent to which a list of 48 adjectives matched their current emotional state	BPD and anorexia groups reported a significantly greater level of negative emotional experience of above average intensity.

Authors	Characteristics of the BPD sample	Comparison Groups	Tasks	Findings
Russell, Moskowitz, Zuroff, Sookman & Paris (2007)	▪ N=38 ▪ mean age = 27.8 (SD = 5.7) ▪ 100% female	▪ Normal controls	Participants recorded interpersonal encounters over a 20 day period, selecting their emotion during each encounter from a list of nine adjectives and rating its intensity.	Significantly greater intensity of negative emotions in the BPD sample but no difference between groups for positive emotions.
Ebner-Priemer, Welch, Grossman, Reisch, Linehan & Bohus (2007)	▪ N=50 ▪ mean age = 31.3 (SD = 8.1) ▪ 100% female	▪ Normal controls	Participants signalled randomly over 24-hour period and asked to select their current emotional state from a list of seven basic emotions and to rate its intensity. Heart rate also measured.	Significantly greater intensity of negative emotions in the BPD sample but no difference between groups for positive emotions. Significantly greater frequency of heart rate acceleration during the 24-hour period.
Bland, Williams, Scharer & Manning (2004)	▪ N=35 ▪ mean age = 32.3 (SD = 8.5) ▪ 100% female	▪ Normal controls	Affect Intensity Measure (AIM; Larson & Diener, 1987)	Significantly higher mean score on the AIM in BPD sample.
Levine, Marziali & Hood (1997)	▪ N=30 ▪ mean age = 37.6 (SD = 7.8) ▪ 66% female	▪ Normal controls	Negative items from the AIM (Larson & Diener, 1987)	Significantly higher mean score on negative items from the AIM in BPD sample.
Koenigsberg, Harvey, Mitropoulou, Schmeidler, New, Goodman, Silverman, Serby, Schopick & Siever (2002)	▪ N=42 ▪ mean age = 34 (SD = 8.3) ▪ 60% female	▪ Other PD group but not BPD	AIM (Larson & Diener, 1987)	Significantly higher mean score on the AIM in BPD sample. BPD group also significantly younger.
Henry, Mitropoulou, New, Koenigsberg, Silverman & Siever (2001)	▪ N=29 ▪ mean age = 32.3 (SD = 7.5) ▪ 69% female	▪ Bipolar II but no BPD ▪ BPD and Bipolar II ▪ Other Personality Disorder but no BPD or Bipolar II	AIM (Larson & Diener, 1987)	No difference in mean AIM score between groups.

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An investigation into the nature of emotional dysregulation in borderline personality disorder

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This paper is written in the format ready for submission to Behaviour Research and Therapy. Please see Appendix 3 for the 'Guide for Authors'.

1. Abstract

Dysregulation of the emotional domain is considered the core disorder in borderline personality disorder (BPD), and a greater intensity of emotional reaction is seen as central to this dysregulation. Empirical data has shown that people with BPD experience negative emotions more intensely than controls, however there is currently little support for the concept of dysregulation across the range of emotional experience. Recent neuroimaging data has revealed a possible neurobiological basis for greater intensity of emotional response, but used stimuli that did not control for potential confounding variables. In this study the emotional intensity of both negative and positive emotion was compared between a BPD sample (n=24) and non-clinical control group (n=24). Participants completed questionnaires to assess emotional intensity and rated their reactions to emotional stimuli in pictorial form. A subgroup of the non-clinical sample (n=5) also viewed the stimuli in a functional magnetic resonance imaging (fMRI) scanner. The BPD subjects reported a greater intensity of emotional reaction, which was mediated by the effects of current anxiety. This difference did not however manifest in ratings of the emotional stimuli. The preliminary fMRI data supported the results of a previous neuroimaging study and indicated future areas of investigation. The positive stimuli were found to have no effect on the emotional processing system when compared to the negative stimuli. The implications of the results are discussed with reference to the wider literature.

Keywords: borderline personality disorder, emotion regulation

2. Introduction

Borderline personality disorder (BPD) is a complex disorder characterised by a pervasive pattern of instability in emotional regulation, impulse control, interpersonal relationships and self-image. Clinical features of the disorder can include impulsivity, anger management problems, affective instability, a pattern of unstable interpersonal relationships, recurrent self-injurious behaviour and chronic suicidal tendencies (American Psychiatric Association, 1994). It is thought to be prevalent in 1-2% of the general population (Torgersen, Kringlen & Cramer, 2001). It has been reported that the suicide rate in people with BPD may be as high as 8% (Adams Bernat, & Luscher, 2001) and it is associated with a significant increase in presentation to Accident and Emergency departments following self-injurious or self-poisonous behaviour (Forman, Beck, Henriques, Brown & Beck, 2004). Subsequently BPD is a serious disorder that presents a major challenge to services and can have a significant effect on the level of functioning of individuals diagnosed with the disorder.

The treatment strategy with the most empirical support is Dialectical Behaviour Therapy - DBT (Bohus, Haaf, Simms, Limberger, Schmahl, Unckel, Lieb & Linehan, 2004; Koons, Robins, Tweed, Lynch, Gonzalez, Morse, Bishop, Butterfield & Bastian, 2001; Verheul, van den Bosch, Koeter, De Ridder, Stijnen & van den Brink, 2003; van den Bosch, Verheul, Schippers & van den Brink, 2002). This treatment approach was proposed by Linehan (1993a) and incorporates a range of interventions including cognitive

modification, cue exposure and skill training focusing on mindfulness, interpersonal effectiveness, emotional modulation and distress tolerance. The underlying theory of the approach is that an impairment of emotional regulation is the core mechanism of BPD and that the other symptoms are secondary to this dysregulation (Linehan, 1993b). Thus impulsivity, intense anger and self-defeating behaviour are seen as learned strategies that attempt to regulate emotional reactions and are reinforced by reductions in emotional intensity. It is proposed that this emotional dysregulation is caused by a complex interaction of genetic, developmental and environmental factors.

Central to Linehan's (1993b) conceptualisation of emotion dysregulation is that emotional reactions, both positive and negative, are experienced more intensely by people with BPD. This concept has received some empirical support from a number of experimental studies. Time-sampling studies have demonstrated that when recorded over a period of time, people with BPD reported a higher frequency and a greater intensity of negative emotions than controls (Russell, Moskowitz, Zuroff, Sookman & Paris, 2007; Ebner-Priemer, Welch, Grossman, Reisch, Linehan & Bohus, 2007). A number of studies using self-report questionnaires have provided evidence that people with BPD rate their negative emotions to be more intense than controls (Levine, Marziali & Hood, 1997; Bland, Williams, Scharer & Manning, 2004) and people meeting the criteria for other Axis II disorders (Koenigsberg, Harvey, Mitropoulou, Schmeidler, New, Goodman, Silverman, Serby, Schopick & Siever, 2002). Other studies have investigated physiological responses to emotional reactions and reported contradictory results. A significantly

increased startle response, which is amplified by negative effect, has been demonstrated in BPD samples when compared to controls (Hazlett, Speiser, Goodman, Roy, Carrizal, Wynn, Williams, Romero, Minzenberg, Siever & New, 2007; Ebner-Priemer, Badeck, Beckmann, Wagner, Feige, Weiss, Lieb & Bohus, 2005). However, Herpertz, Kunert, Schwenger & Sass (1999) found no significant difference in startle response in a BPD sample while viewing emotional pictures. Furthermore, the BPD group was found to have a significantly lower skin conductance when compared to controls, which was interpreted as emotional underarousal. It is also notable that the majority of the experimental studies investigating emotional intensity do not control for current mood despite evidence the emotion generation system can be affected by both anxiety (e.g. Thomas, Drevets, Dahl, Ryan, Birmaher, Eccard, Alexson, Whalen & Casey, 2001) and depression (e.g. Drevets, 1998). Consequently many questions about the specific nature of emotional intensity in BPD remain unanswered.

Recent advances in neuroimaging techniques have led to an increase in the investigation of the neural correlates of emotional reactions. The generation of emotion involves a wide range of cortical structures, but activation appears particularly dense in sections of the prefrontal cortex and specifically the amygdala (Davidson & Irwin, 1999). In a non-clinical sample neuroimaging has been used to demonstrate amygdala activation to negative emotional stimuli (Lane, Chau & Dolan, 1999). Herpertz, Dietrich, Wenning, Krings, Erberich, Willmes, Thron & Sass (2001) showed participants negative and neutral pictorial stimuli under functional magnetic resonance imaging (fMRI)

scanning conditions. A sample of six non-medicated females with borderline personality disorder and no co-morbid diagnosis were compared to age and sex-matched controls. The results indicated greater amygdalic activation to the negative stimuli in the BPD group when compared to controls. Furthermore, increased activation was shown in small areas of the prefrontal cortex and the fusiform gyrus (Herpertz, 2003). This interesting result raises a number of further questions. The small sample size was justified by the stringent exclusion criteria of any concordant Axis I disorders, however, given the high level of co-morbidity in people with BPD (Skodol, Gunderson, Pfohl, Widiger, Livesley & Siever, 2002) the ecological validity of such a sample may be questioned. The stimuli used in the study may also provide a possible confound in the form of facial expressions. The majority of the negative stimuli shown to participants in the study contained facial expressions conveying emotions of sadness, anger or fear. This is in contrast to the neutral stimuli in which no human faces were present. This point is open to debate considering that six of the facial expressions used in the negative condition occurred in the context of serious injuries. However, it may be that the result is influenced by the mechanisms responsible for the recognition of emotion in facial expressions, especially given the central role of the amygdala in the perception of negative affect (Davidson & Irwin, 1999).

Another notable limitation of the current literature is the emphasis on negative emotion. Linehan (1993b) proposes that emotion is experienced with significantly greater intensity by people with BPD irrespective of the hedonic valence of each emotional reaction, but that the difference may be more

pronounced in negative emotions. Evidence that people with BPD report less frequent positive emotional experience than controls (Russell et al, 2007) suggests that it may be more difficult to detect differences in the intensity of positive emotion in BPD samples. There is a paucity of empirical support for an increased intensity of positive emotional reactions in the current literature. Experimental studies that have included positive stimuli have failed to demonstrate a difference between BPD and control groups, however these studies have made little attempt to match the salience of the positive stimuli to the corresponding negative stimuli. In a non-clinical sample comparable activation of the amygdala to both positive and negative stimuli has been demonstrated when two sets of stimuli were matched for level of emotional intensity (Lane et al, 1999). This raises the possibility that the hypothesised over-activation of the emotion generation system could be demonstrated with a sensitive experimental design. This remains an important area of investigation to future understanding of the mechanisms of emotional dysregulation in BPD.

The aim of the present study was to investigate the mechanisms of emotional intensity in people with BPD for both negative and positive emotions. Self-report measures were selected to detect differences in the intensity of emotional reactions and the effect of current anxiety and depression. In order to extend previous findings and investigate the effects of emotion intensity under experimental conditions the stimuli selected to evoke negative and positive emotions were matched for both emotional intensity and the presence of facial expressions. The hypotheses of the study are:

1. People with BPD will report their emotions to be more intense than controls on self-report measures, and this difference will remain significant when the effects of anxiety and depression are controlled for.

2. People with BPD will rate their emotional reactions to emotional stimuli as more intense than controls in both negative and positive conditions when these stimuli are matched for level of intensity.

3. Under fMRI scanning conditions the same stimuli will cause activation of the amygdala and interconnected cortical structures when the presence of facial expressions is controlled for.

3. Study 1

3.1. Method

3.1.1. Participants

The recruitment site for the study was an independent hospital with a specialist one-year programme for females with self-defeating behaviour. The programme was a therapeutic community based on the principles of DBT. However, recruitment to the inpatient sample was slow due to the limited number of inpatient beds and the length of stay of clients on the programme. To increase recruitment to the study, further ethical approval was gained to recruit outpatients. Letters were sent out to clients in the community who had

left the programme during the previous five years inviting them to take part in the study. Sixty-four invite letters were sent in total with a response rate of 31% (with a further 9% undelivered). Any further contact with non-responders was prohibited by the ethics committee. All participants were administered the Structured Clinical Interview for DSM-IV Axis II Disorders (SCID-II; First, Spitzer, Gibbon & Williams, 1996) to confirm the diagnosis of BPD and to record concurrent Axis II disorders. Subsections of the Structured Clinical Interview for DSM-IV Axis I Disorders (SCID-I; First, Spitzer, Gibbon & Williams, 1997) were also administered to screen for co-morbid mood disorders, post traumatic stress disorder (PTSD), eating disorders, schizophrenia and current substance abuse disorders.

The control group was recruited through the staff team at the hospital and a local university, and contained only females to match the clinical sample. All participants were administered the screening modules of the SCID-I (First *et al*, 1997) and SCID-II (First *et al*, 1996). The sample had no lifetime history of the screened Axis I disorders and did not meet diagnostic criteria for any Axis II disorder.

3.1.2 Measures

The following measures were used in the study:

Affect Intensity Measure (AIM; Larsen & Diener, 1987). The AIM is a 40-item self report measure that assesses the general intensity of emotional reactions

to everyday life events. Statements are rated on a 6-point scale and the mean score is calculated to give an overall measure of emotional intensity. The measure includes items that relate to both positive and negative emotions. Adequate validity has been demonstrated by significant correlations with reported daily affect intensity and a test-retest reliability of 0.81 after three months has also been demonstrated (Larsen & Diener, 1987).

Affective Control Scale (ACS; Williams, Chambless & Ahrens, 1997). The ACS is a 42-item self report measure that assesses fear of intense emotional reactions. Items are rated on a 7-point scale and include items relating to positive emotion, anxiety, fear and depression. The convergent validity of the measure has been demonstrated by a correlation of -0.72 with a reverse scored measure of emotional control and discriminant validity demonstrated by a correlation of -0.17 with a measure of social desirability. A test-retest reliability of 0.78 after two weeks has also been demonstrated (Williams *et al*, 1997).

Hospital Anxiety and Depression Scale (HADS; Zigmond & Snaith, 1983). The HADS was administered to assess current levels of anxiety and depression. The HADS is a well established self-report measure that assesses current functioning on two subscales, anxiety and depression, which can be combined to give a full-scale score. The discriminate and convergent validity of the measure has been established in a number of studies (Bjelland, Dahl, Haug & Neckelmann, 2002) and its reliability has been demonstrated with Cronbach's

alpha scores of 0.82, 0.77 and 0.86 in a large community sample (Crawford, Henry, Crombie & Taylor, 2001).

International Affective Picture System (IAPS; Lang, Bradley & Cuthbert, 2005). The emotional stimuli consisted of 30 colour pictures taken from the IAPS (Lang *et al*, 2005), which is a large database of colour photographs including objects, animals, people and non-social scenes. Every picture in the IAPS has corresponding normative data to indicate its hedonic valence and relative intensity as rated on a 9-point scale by a large non-clinical sample. The stimuli were grouped into three conditions (negative, positive and neutral) consisting of ten pictures each. The negative stimuli consisted of natural disasters, war and people in distress (with a mean valence of 2.18 (SD=0.53) and mean intensity of 5.39 (SD=0.9)). The positive stimuli consisted of natural landscapes, scenes of success and people demonstrating enjoyment or success (with a mean valence of 7.66 (SD=0.14) and mean intensity of 5.43 (SD=0.34)). The neutral stimuli consisted of inanimate objects and neutral social scenes (with a mean valence of 5.11 (SD=0.17) and mean intensity of 2.99 (SD=0.46)). The mean hedonic valence of the pictures was significantly different between conditions ($F(2,33)=859$, $p<0.001$). Furthermore there was no significant difference between the relative intensity of the negative (mean=5.4, SD=0.87) and positive (mean=5.4, SD=0.35) stimuli ($t(22)=0.06$, $p=0.95$). All conditions contained a mixture of social and non-social scenes, with facial expressions controlled for. For ethical reasons the stimuli were approved in a pilot study by a small group of clients on the programme who

did not take part in the main study. It was decided that potentially traumatic pictures (e.g. mutilated bodies) would not be used in the study.

Self-Assessment Manikin (SAM; Lang, 1980). The SAM was used to measure emotional reactions to the stimuli. The SAM is a pictorial assessment scale that measures subjective ratings of relative intensity of emotional reaction and hedonic valence, from pleasant to unpleasant, on a 9-point scale. This measure was chosen as it was used to collect the normative data for the images in the IAPS (Lang *et al*, 2005).

3.1.3. Procedure

The study was granted a favourable ethical opinion by the local Research Ethics Committee (Appendix 4). Participants who expressed an interest in taking part in the study were given an information sheet with a full description of the study procedure (Appendix 5). They were then seen individually in a quiet room to provide privacy and minimise any disruptions. Informed consent was obtained with a standard form (Appendix 6). Participants were asked to provide demographic information (age, race/ethnicity, marital status, employment status, highest level of education and current medication) on a structured form (Appendix 7). All participants were administered the screening modules of the SCID-I and SCID-II and subsequent sections of the structured interview schedules if indicated by the screening modules. The self-report questionnaires were completed by all participants in the same order; AIM, ACS and HADS (Appendix 8). Participants were given the SAM along with

written instructions describing how to use the scale. Each participant then viewed the colour pictures from the IAPS on an A4 flipchart. The stimuli were presented by the experimenter in blocks of three, with one picture from each stimuli condition. The order was randomised within each block to avoid effects from the order of presentation. Participants indicated their initial reaction to the stimuli using the 9-point SAM scale to rate each picture in terms of hedonic valence and relative intensity of emotional reaction. Participants were then debriefed.

3.2. Results

The demographic variables for the two groups are presented in Table 1. There was no significant difference between the two groups in either age or level of education.

Table 1: Demographic variables between groups

Information about concordant Axis I and Axis II disorders in the BPD sample is shown in Table 2.

Table 2: Concordant Axis I and Axis II disorders in the BPD sample

Between-group comparisons were made for all experimental measures. Mean scores for each measure between groups is presented in Table 3.

Table 3: Mean (SD) scores for experimental measures

A univariate, two-sample T-test was undertaken to compare AIM scores between the BPD group and control sample. As hypothesised the BPD group reported significantly higher scores on this measure ($t(46) = 2.35$, $p = 0.023$). A further analysis of covariance (ANCOVA) was undertaken with scores on the HADS anxiety (HADSa) and depression (HADSd) subscales included as potential covariates. The results indicated that HADSa score was a significant covariate ($F(1,44) = 6.77$, $p = 0.013$) and when this variable was controlled for the difference in AIM score between groups was no longer significant ($F(1,44) = 1.15$, $p = 0.29$).

A univariate, two-sample T-test was then undertaken to compare ACS scores between groups. This indicated significantly higher ACS scores in the BPD group ($t(46) = 10.88$, $p < 0.001$). An ANCOVA was undertaken with HADSa and HADSd scores as potential covariates, of which HADSa score was found to be a significant covariate ($F(1,44) = 16.78$, $p < 0.001$). However, with this covariate controlled for in the analysis the difference in ACS scores between groups remained significant ($F(1,44) = 41.77$, $p < 0.001$).

In order to ensure that the hedonic valence of the stimuli had been rated similarly in both groups a multivariate, Wilks' lambda test was undertaken to compare mean valence score on the SAM scale for the three stimuli conditions (positive, negative and neutral). No significant group differences were found ($F(3,44) = 2$, $p = 0.128$), suggesting that the hedonic valence

assigned to the stimuli was comparable between groups. A further multivariate, Wilks' lambda test was undertaken to compare the mean reported intensity of reaction to the stimuli on the SAM scale between groups and stimuli conditions. No significant between-group differences were found for the intensity ratings ($F(3,44) = 0.3$, $p = 0.822$).

3.3. Discussion

Consistent with Bland et al's (2004) and Koenigsberg el al's. (2002) findings, the results of Study 1 partially support the hypothesis that people with BPD report their emotions to be more intense than controls on self-report measures. However, in the current study the higher mean score on the AIM measure in the BPD sample was no longer statistically significant after anxiety was controlled for. This result suggests that the difference may be mediated by underlying symptoms of anxiety. The AIM was developed with the rationale that intensity of emotional experience is a stable personality trait that can be measured between individuals (Larsen & Diener, 1987). However, it is increasingly recognised that acquired anxiety disorders, and particularly PTSD, can lead to an over-arousal of the emotion generation system and an increase in the intensity of negative emotional experience (e.g. Frewen & Lanius, 2006). This is an important consideration given the high concordance rate of PTSD in the current BPD sample.

The ACS is a self-report measure that assesses a subtly different aspect of emotional intensity. It was developed as an extension of the 'fear of fear'

construct to assess anxiety about intense emotional reactions regardless of their hedonic valence (Williams et al, 1997). In particular, the measure assesses the respondent's concern about overwhelming emotional reactions that may occur within everyday experiences. The results of the current study demonstrated significantly higher scores on the ACS even when the effects of current anxiety and depression were controlled for, and as far as the author is aware this is the first time such a difference has been shown in a diagnostic sample.

The results of the experimental paradigm do not support the hypothesis that people with BPD will rate their emotional reactions to negative and positive emotional stimuli as more intense than controls when these stimuli are matched for level of intensity. It may be that the pictures were not emotionally salient enough to detect subtle difference between groups, however the result does replicate a previous study using different IAPS stimuli (Herpertz et al, 1999). Taken together these results suggest that it may not be possible to demonstrate increased emotional intensity under experimental conditions using non-specific emotional stimuli. It is worth noting that the two self-report measures in the present study rely on statements relating to general emotional experience. Subsequently it is left to the respondent to relate these statements to relevant prior experiences of emotional reactions, which may be more idiosyncratic and salient than the more generalised pictorial stimuli. However, the later Herpertz et al (2001) study that used these stimuli under scan conditions suggests that they may be sensitive enough to detect differences in more objective measures of emotion generation.

4. Study 2

4.1. Method

4.1.1. Participants

Five participants were recruited to the second phase of the study from the original control group. The participants in this subgroup were selected on the basis that they were willing to take part in the brain scan procedure and were available to do so. Participants had no lifetime history of the screened Axis I disorders and did not meet diagnostic criteria for any Axis II disorder as previously assessed with the screening modules of the SCID-I (First et al, 1997) and SCID-II (First et al, 1996). All participants were right-handed and were not taking any medication at the time of scanning. At the time of writing the data collection was ongoing and a corresponding BPD sample was not sufficiently large enough for the fMRI data to be analysed at a group level. This sample has subsequently been omitted from the report.

4.1.2. Procedure

Participants were accompanied to the fMRI scanner by the author. The visual stimuli from Study 1 were projected onto a screen behind the head and viewed with an angled mirror placed in front of the eyes. The task instructions were displayed to participants for 24 seconds before fMRI data acquisition started. A simple block design was used in the study. A 12-second fixation

cross alternating with 12-second stimuli blocks. Each stimuli block contained all 10 pictures from the relevant stimuli condition presented in a random order for 1200ms each. A total of 24 stimuli blocks were used in total, with eight blocks of stimuli condition alternating with the fixation cross in a random order of presentation. Nine 'catch' trails were also included, in which a red dot appeared on one of the pictures and a response with the right index finger was required on a button. Any participant with a response rate of less than 70% to these trails was assumed to not be attending to the pictures and their data discarded. Data acquisition took 576 seconds in total. The experimental design is shown schematically in Figure 1.

Figure 1: Example trial block (Neutral)

4.1.3. Image Acquisition

Blood oxygen level-dependant (BOLD) fMRI data were acquired using a GE 3.0T Signa Excite HDx scanner. A 13-second standard localiser was run to determine head position. The fMRI data were acquired using a gradient Echo Planar Imaging (EPI) sequence with Time to Repetition (TR) of 3000, Time to Echo (TE) of 32.7 and a flip angle of 90°. Thirty-nine contiguous axial slices of 3mm thickness at 2x2 mm inplane resolution were used to ensure full brain coverage. Acquisition orientation was standardised by inplane prescription parallel to the corpus callosum. To improve offline data co-registration a high resolution T1 Fluid Attenuated Inversion Recovery Sequence (T1 FLAIR) with 0.5x0.5mm inplane resolution and 3mm slice thickness was acquired

(TR=2293.4, TE=10.5, flip=90°). The prescription of this acquisition exactly mirrored the co-ordinate frame of the EPI data. To facilitate high-resolution data analysis a sagittal isotropic 3D Fast Spoiled Gradient Recall Echo structural T1 weighted scan was used (Matrix size: 256x256x176, slice thickness: 1.13x1.13x1.0mm, TR=8.03, TE=3.07, flip=20˚). Stimulus presentation and data acquisition were controlled using Presentation® software (Version 9.9, www.neurobs.com) on Microsoft Windows XP on a 3.6Ghz Processor 1Gb RAM computer.

4.1.4. Analysis

The data were analysed by the author following two, full-day workshops on analysis methods. Data were analysed on an individual level using FEAT (FMRI Expert Analysis Tool) Version 5.63, part of FSL (FMRIB's Software Library, www.fmrib.ox.ac.uk/fsl). Initial co-registration to the T1 FLAIR, followed by co-registration to the isotropic T1 and standard MNI (Montreal Neurologic Institute) brain image was carried out using FLIRT (Jenkinson & Smith, 2001, Jenkinson, Bannister, Brady & Smith, 2002). The following pre-statistics processing was applied; motion correction using MCFLIRT (Jenkinson *et al*, 2002); slice-timing correction using Fourier-space time-series phase-shifting; non-brain removal using BET (Smith, 2002); spatial smoothing using a Gaussian kernel of FWHM 3mm; mean-based intensity normalisation of all volumes by the same factor; highpass temporal filtering (Gaussian-weighted least-squares straight line fitting, with sigma=50.0s). Time-series statistical analysis was carried out using FILM with local autocorrelation

correction (Woolrich, Ripley, Brady & Smith, 2001) to create contrast images for individual participants summarising differences between stimuli conditions. Z (Gaussianised T/F) statistic images were thresholded using clusters determined by Z>2.3 and a (corrected) cluster significance threshold of P=0.05 (Worsley, Evans, Marrett & Neelin, 1992). Data were subsequently analysed on a group level. Higher-level analysis was carried out using FLAME (FMRIB's Local Analysis of Mixed Effects) stage 1 only (without the final MCMC-based stage), (Beckmann, Jenkinson & Smith, 2003; Woolrich, Behrens, Beckmann, Jenkinson & Smith, 2004). Z (Gaussianised T/F) statistic images were thresholded using clusters determined by Z>1.7 and a (corrected) cluster significance threshold of P=0.05 (Worsley et al, 1992).

4.2. Results

The participants were five, right-handed females with a mean age of 28.8 years (SD=10.2). All participants had no current or prior history Axis I disorders, no Axis II disorders and were not currently taking any medication. The mean level of education of the sample was 14.4 years (SD=2.6).

Statistical maps were created to investigate the main effect of the negative and positive stimuli conditions with regions of activation associated with the neutral stimuli subtracted. The regions of significant activation are presented in Table 4.

Table 4: Group activation for 'negative' and 'positive' conditions

Additionally statistical maps were created to investigate direct contrasts between the negative and positive stimuli conditions. There was found to be no significant regions of activation for the 'positive > negative' contrast. The results of the 'negative > positive' contrast are presented in Table 5.

Table 5: Group activations for 'negative > positive' contrast

4.3. Discussion

The results reported in Study 2 should be considered preliminary and are reported as a guide to further investigation in this area. The hypothesis that emotional, pictorial stimuli matched for intensity and the presence of facial expressions would elicit amygdala activation was not supported by the generated statistical maps. This is likely to be attributable to a lack of statistical power due to the sample size and the small size of the region of interest. The present study did however demonstrate activation to the negative stimuli in areas with connections with the amygdala. As in the Herpertz et al (2001) study, a significant area of activation was demonstrated in the fusiform gyrus, which is involved in visual recognition. In the original paper this was interpreted as the influence of amygdalic projections to the area to modulate the emotional salience of the negative stimuli. However, as the fusiform gyrus also has a central role in the detection of faces (Britton, Shin, Barrett, Rauch & Wright, 2008) the result may have been attributable to the absence of faces in the neutral stimuli. The present study provides

evidence that the fusiform gyrus is activated by negative stimuli even when the presence of facial expressions is controlled for and provides support to the original interpretation.

The results also indicated activation in the posterior cingulate for the negative stimuli, which has been previously shown to be activated by emotional stimuli and is linked to information encoding in episodic memory (Maddock, Garrett & Buonocore, 2003). This may be an important region of interest in future studies. Other areas of activation indicated relate to the occipital lobe (cuneus and lingual gyrus) and are likely to be reflective of visual features of the stimuli that would have been averaged out in a larger sample. This does however highlight the need for complex variables in visual stimuli, for example contrast or number of objects in a scene, to be considered as investigation in this area progresses.

In the direct contrasts between positive and negative stimuli, the areas of activation related to emotion processing were shown to be attributable only to the negative stimuli. Consequently the hypothesis that positive stimuli matched to the negative stimuli for intensity would lead to comparable activation was not supported by the results.

5. General Discussion

The results of the current investigation raise interesting questions about the mechanisms of emotional intensity in BPD. The effect of current anxiety has

not been adequately addressed in previous studies using BPD samples. It may be that the elevated negative emotional intensity that has been demonstrated (e.g. Hazlett et al, 2007; Ebner-Priemer et al; 2007; Bland et al, 2004) is mediated by underlying symptoms of anxiety. The significant difference in ACS score between groups even when the effects of anxiety and depression were controlled for provides further information about this result. The ACS measures a specific anxiety relating to emotional intensity, namely a fear of the consequences of overwhelming emotional reactions. This anxiety may be related in an interactional manner to the wider symptomology of BPD, such as intense anger and chronic feelings of emptiness, and a potential cause of behavioural strategies that attempt to regulate emotion, such as self-harm and dissociation. This is a tentative hypothesis that would need to be tested with further measures of the construct and qualitative data about the subjective experience of emotion in people with BPD. However, in order to elucidate the mechanisms of elevated emotional intensity in people with BPD it appears essential that the effects of anxiety are controlled for.

The present study was similar to previous studies in failing to find any direct experimental evidence of a greater intensity of positive emotions in people with BPD (Russell et al, 2007; Herpertz et al, 1999). As such empirical evidence for increased emotional intensity is currently limited to negative emotion and the concept of a general dysregulation (Linehan, 1993b) remains unsupported. This may be due to the mythological difficulties of investigating positive emotion (e.g. Fredrickson, 1998), or because such a difference does not exist for positive emotion. The results of the Study 2 seem to suggest that

the neural correlates of emotional reactions to positive pictorial stimuli are distinct from those that process corresponding negative stimuli. Furthermore, a previous PET study demonstrated differential patterns of activation to negative and positive stimuli in a non-clinical sample, with greater activation in the amygdala to negative stimuli and greater activation in the prefrontal cortex to positive pictures (Paradiso, Johnson, Andreasen, O'Leary, Watkins, Ponto & Hichwa, 1999). Consequently it may be that a different experimental paradigm using highly relevant emotional stimuli and sensitive imaging techniques will be needed to ascertain whether such a difference can be detected.

Some further limitations of the current study are acknowledged. Given the high level of concordant Axis II disorders it would have been preferable to have an Axis II comparison sample in order to ensure that significant results are attributable to the diagnosis of BPD. The sample also met criteria for a high proportion of Axis I disorders, and although this was addressed to some degree by the assessment of current anxiety and depression, a further clinical sample may have been useful, particularly a group meeting criteria for PTSD and not BPD. However, inclusion of a BPD sample with no concurrent Axis I disorders was not felt to be reflective of the prevalence data for co-morbidity in BPD (e.g. Skodol et al, 2002) so the current sample does have the advantage of ecological validity. A further limitation was the absence of a measure of current dissociation. In a correlational analysis the extent of thought suppression has been shown to mediate the relationship between emotional intensity and number of BPD symptoms (Rosenthal, Cheavens, Lejuez &

Lynch, 2005), and transient dissociative states are included in the diagnostic criteria for BPD. Further investigation may need to consider the effect this could have on experimental procedures designed to evoke emotion. Finally due to constraints on recruitment all participants in the study were female which may affect the generalisabilty of the results to BPD in males. Future studies could investigate the manner in which established gender differences in emotional experience (Fischer, Rodriguez Mosquera, van Vianen & Manstead, 2004) manifest in BPD.

In conclusion, this study provides empirical support for the role of anxiety, and particularly anxiety about overwhelming emotional reactions, in the greater intensity of negative emotions in people with BPD. Further investigation is required to investigate the nature in which this difference manifests in emotional reactions to specific stimuli. The study also provides potential future directions for investigating the experience of positive emotion, and supports the role of neuroimaging in this process.

Word count: 5,649

Table 1: Demographic variables between groups

Variable	Group	
	BPD (n=24)	Control (n=24)
Age	33 (10.9)	30 (9.8)
Level of Education (years)	13.5 (2.5)	14.5 (1.9)
Employement		
% employed	33	96
% unemployed	58	4
% retired	8	0
Martial status		
% single	54	83
% married	29	17
% separated/divorced	17	0
Race/ethnicity		
% british	92	92
% mixed race	8	4
% german	0	4

Table 2: Concordant Axis I and Axis II disorders in the BPD sample

Variable	Frequency in BPD sample (n=24)
Axis I	
Mood disorders	
current	7 (29%)
lifetime	12 (50%)
PTSD	
current	14 (58%)
prior	1 (4%)
Eating disorders	
current	6 (25%)
in remission	6 (25%)
Alcohol/substance dependence	
current	0
in remission	7 (29%)
Axis II	
Avoidant	16 (67%)
Dependent	8 (33%)
Obsessive-compulsive	7 (29%)
Paranoid	7 (29%)
Schizotypal	2 (8%)
Narcissistic	1 (4%)
Schizoid	0
Histrionic	0
Antisocial	0

Table 3: Mean (SD) scores for experimental measures

	Group	
Measure	BPD (n=24)	Control (n=24)
AIM	3.81 (0.7)	3.36 (0.63)
ACS	4.9 (0.85)	2.59 (0.6)
HADS		
anxiety	12.75 (5.49)	5.96 (3.64)
depression	8.92 (6.11)	1.5 (1.87)
SAM intensity score		
negative	5.71 (1.98)	5.3 (1.75)
positive	4.57 (1.87)	4.22 (1.67)
neutral	2.46 (1.31)	2.1 (1.37)

Figure 1: Example trial block (Neutral)

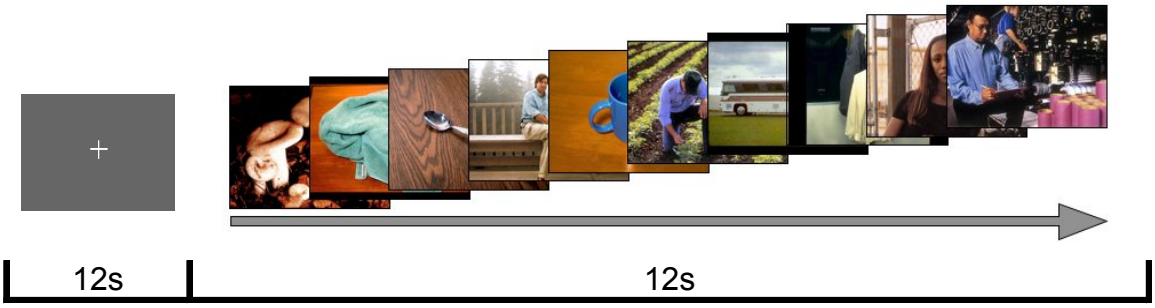

Table 4: Group activation for 'negative' and 'positive' conditions

Region of Activation	Brodmann	Z-Max	Coordinates		
			x	y	z
Main Effect: Negative					
Lingual Gyrus	L18	3.02	20	-74	-8
Fusiform Gyrus	R37	2.94	38	-56	-18
Cuneus	R	2.93	10	-96	6
	R17	2.85	4	-94	0
	R17	2.82	2	-98	-4
Middle Occipital Gyrus	R19	2.9	54	-72	4
Posterior Cingulate	L	2.66	-12	-62	14
	L	2.3	-6	-60	14
Postcentral Gyrus	L	2.39	-16	-36	62
Medial Frontal Gyrus	L	2.38	-2	-30	58
Parietal Lobe, Sub-Gyral	L	2.33	-22	-38	48
Main Effect: Positive					
Cuneus	R17	3.22	4	-94	0
	R17	3.17	2	-96	-4
	R	3	8	-98	6
Lingual Gyrus	L	3.09	-10	-90	-10
Middle Occipital Gyrus	R	3.01	48	-82	-2
	R19	2.99	50	-76	-2

* all activations are significant at the $p<0.05$ level

** coordinates are in MNI space

Table 5: Group activations for 'negative > positive' contrast

Region of Activation	Brodmann	Z-max	P	Coordinates			Voxels
				x	y	z	
Posterior Cingulate	R	2.65	<0.001	4	-54	12	4082
Medial Frontal Gyrus	L9	2.62	<0.001	-6	46	32	1850
Superior Temporal Gyrus	R	2.58	0.002	50	-50	14	1308
	L	2.44	0.007	-64	-62	0	1014

* coordinates are in MNI space

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Appendixes

Appendix 1

Reflective Statement

1. Introduction

A reflective journal has been maintained to record reflections on the research process throughout its progression. Examining this document retrospectively at the end of the research process reveals a number of themes that have arisen during this time. This statement begins by reflecting on the 'borderline' diagnosis and the issues that have arisen while investigating its mechanisms. The measures used within the study are then considered with reference to the original rationale for selecting them. The importance of reporting non-significant results is then discussed.

2. The 'borderline' diagnosis

A principle theme that has emerged throughout the research process is the usefulness of the 'borderline' diagnosis. This debate has arisen within the literature, but also during the data collection process. The term 'borderline; originated in psychodynamic theory in the early 20th century (Stern, 1938) and continues to be used within the DSM-IV (American Psychiatric Association, 1994) in the diagnostic category of borderline personality disorder (BPD). However, there is a certain imprecision about the term and the heterogeneity within BPD samples has led some to question the dimensional system of classification (e.g. Clark, Livesley & Morey, 1997). A number of discussions with participants during the data collection process have reflected this view, with many questioning the use of the BPD diagnosis in clinical practice and a

few participants describing incidents in which they felt stigmatised within primary care services as a result of the diagnosis.

The concerns raised about the dimensional classification system of diagnosis led to an interesting conflict between its use in clinical settings and its use in a research context. From a clinical perspective the role of individualised assessment procedures that draw on a range of theoretical models is emphasised as a important component of the work of a Clinical Psychologist (Harvey, 2001), and thus categorical diagnoses are considered of limited use. On the other hand, diagnostic categories are implicit in any methodical, quantitative study that attempts to investigate the mechanism of some aspect of the diagnosis by minimising individual differences with sampling procedures. This conflict may be possible to reconcile with due consideration of the role of Clinical Psychologists as scientist-practitioners and the need to undertake research that informs clinical practice (Harvey, 2001). In many ways the biosocial model (Linehan, 1993) attempts to address the heterogeneity of the BPD diagnosis by proposing a core mechanism of the disorder which manifests in an idiosyncratic manner. It is only by using scientific rigour and the diagnostic criteria available to us that the commonalities within BPD can be investigated and empirical evidence provided to guide treatment strategies that may then incorporate a more individualistic approach to the disorder.

3. Decisions about experimental measures and methods

Another core theme within the reflective journal relates to decisions taken about the experimental methodology. These will now be considered in order.

3.1.Self-report Questionnaires

Two self-report questionnaires were chosen for the study: the Affect Intensity Measure (AIM; Larsen & Diener, 1987) and the Affective Control Scale (ACS; Williams, Chambless & Ahrens, 1997). These questionnaires were chosen to reflect different but related aspects of emotional intensity and provided interesting results. One initial concern was the potential unreliability of using self-report questionnaires so prominently in the study, despite the established psychometric properties of the measures (Larsen & Diener, 1987; Williams et al). It was considered necessary however to include self-report data due to the fact that emotion is such a subjective experience. The strength of the questionnaires is that participants are asked to rate their response to generalised scenarios with an emotional component. The feedback received from participants was that they considered these scenarios in the context of past experience of specific situations, which gives the ratings relevance and potentially greater emotional saliency than a more objective measure of emotional intensity. It is felt that this justified the inclusion of the questionnaires in conjunction with the experimental paradigm.

3.2 International Affective Picture System

The decision to use emotional stimuli from the International Affective Picture System (IAPS); Lang, Bradley & Cuthbert, 2005) was informed by its use in previous studies (e.g. Herpertz, Dietrich, Wenning, Krings, Erberich, Willmes, Thron & Sass, 2001; Herpertz, Kunert, Schwenger & Sass, 1999). The subsequent non-significant result led to reflection about this decision, and contemplation about alternative stimuli that may have been used. However, in many ways this process led to an appreciation of the value of the IAPS for investigating emotion. One of the main challenges for research into emotion is the subjectivity implicit within participant responses to emotional stimuli. This point was illustrated eloquently while administering the experiment to a control participant. When rating their emotional response to the IAPS stimuli the participant gave a highly positive rating to one of the negative stimuli. The picture showed a dishevelled and apparently homeless man drinking from a bottle while sat by the side of a road. The picture was associated with a negative emotional reaction in the normative data and had been rated so by previous participants. When questioned during the debrief period this particular participant explained that the man was a coal miner drinking a bottle of milk after a day's work, which was confirmed by closer inspection of other details in the picture. She explained that her reaction had been one of pride for the nobility of the profession. This subjectivity of emotional reaction is a challenge to experimental studies, and the flexibility provided by the sheer number of pictures within the IAPS can attempt to address this. The selection of a wide range of stimuli from a number of different categories seems a

efficient way of controlling for subjective responses in a sufficiently large sample.

3.3 Neuroimaging

The potential to use neuroimaging techniques in the study was considered an opportunity that could not be turned down. Neuroimaging is increasingly used to further understanding of psychological models (Hagoort, 2008) and demonstrate neurobiological changes following successful psychological intervention (Kunami, 2006). Consequently neuroimaging was chosen to reflect the growing literature in the area and to extend previously reported results (Herpertz *et al*, 2001). On reflection the use of this technology may have been over ambitious due to the time constraints of a doctoral project, and data collection was ongoing at the time of writing to maximise the possibility of publication at a later date. The two main difficulties that emerged were recruitment and the length of time required to learn the skills required to undertake data analysis. The magnetic resonance imaging (MRI) scanner is an unusual environment and one that did not appeal to the majority of clients on the inpatient programme. Furthermore, although initially I felt that the relative preciseness of scan data would negate the need for a large sample, as training progressed I realised that neuroimaging is subject to similar methodological constraints as any other quantative investigation. A sufficiently large sample is therefore needed to control for variability between individuals in terms of brain structure and function, and to account for the previously discussed subjectivity within emotional responses. Without the statistical

power provided by a large sample, the validity of a non-significant result could be questioned. The question of significance relates to the other main theme arising in the reflective journal.

4. The reporting of non-significant results

As the time required for data collection came to an end my thoughts centred on the neuroimaging data that had been collected to date. The study initially aimed to investigate differences in the functional anatomy of the generation of negative and positive emotion in people meeting the diagnostic criteria for BPD. However, initial between-groups analysis on the data yielded no significant areas of activation between the BPD and control groups. This was particularly disappointing given the time invested in this part of the study. I began to question whether to even include the neuroimaging data within the empirical paper and in doing so considered a number of issues.

The procedure used in the current study has been used to elicit activation of emotional areas of the brain in non-clinical samples (Irwin, Davidson, Lowe, Mock, Sorenson & Turski, 1996) and was chosen to replicate and extend a previous significant difference in people with BPD (Herpertz *et al*, 2001). Consequently there seemed little reason to question the validity of methodology. Thus the non-significant result could be attributed to either the study not having sufficient statistical power to detect a difference (a Type II error) or that no such difference exists. This brought to mind a recent newspaper article (Goldacre, 2008) that discussed randomised control trials in

the pharmaceutical industry and called for all studies to be registered on a central database at the point of gaining ethical approval. This, it was argued, would reduce the tendency for non-significant results to go unreported in peer-reviewed journals. This 'publication bias' is a recognised phenomenon (Dickersin, 1990) and seemed an important point to consider.

In the current study it is likely that a lack of statistical power was the reason for the lack of significant between-group effects due to the small sample sizes, especially as a difference has previously been shown in a study with larger samples (Herpertz *et al*, 2001). As a result of this assumption, and with due consideration of the problem of publication bias, it was decided that there was value in reporting the significant within-group areas of activation. The current study sought to address possible methodological confounds in the previous study and extend the investigation to positive emotion. The data reported by the study indicates that the IAPS stimuli are able to elicit the expected neurobiological response to negative stimuli even when the effect of facial expressions is controlled for. Furthermore, the results indicate future directions for the investigation of the reaction to positive stimuli. These are informative preliminary results that suggest that between-group differences may be demonstrable with further data collection. It is only by attempting to report the results in a peer-reviewed journal however that they can be useful for future investigation.

5. Conclusions

This reflective statement has critically appraised the research process retrospectively, and in doing so has emphasised aspects of my personal approach to research. The first relates to the use of diagnostic categories in quantative research, and the manner in which this can be reconciled with the clinical role of a Clinical Psychologist. The second theme highlights the need to reflect on decisions made in the early stages of the research process when the results have been obtained, and to use these reflections to guide future methodological decisions. Finally it is useful to reflect on the importance of non-significant results and the effect that disregarding them can contribute to publication bias. These themes are all aspects of a wider learning process that has been undertaken during the study, and it is only by reflecting on this process that this learning can be recognised and incorporated into future research endeavours.

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Appendix 2

Clinical Psychology Review - Guide for Authors

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Appendix 3

Behaviour Research and Therapy - Guide for Authors

Aims and Scope

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Appendix 4

Ethical Approval

Documents to confirm that ethical approval had been granted for the study were inspected at the viva voce and subsequently removed to ensure anonymity.

Appendix 5

Information Sheet

Participant Information Sheet

We would like to invite you to take part in a research study. Before you decide you need to understand why the research is being done and what it would involve for you. Please take some time to read the following information carefully. You can discuss the project with others if you wish. Please ask if there is anything that is not clear or if you would like more information. Take time to decide whether or not you wish to take part.

Title of the study

Emotional Regulation in Borderline Personality Disorder

What is the purpose of the study?

This study will investigate differences in how people with borderline personality disorder regulate their emotions when compared to people without the disorder. It is thought that a difficulty in regulating emotions is an important aspect of borderline personality disorder. Previous research has not made it clear what these difficulties are, and has also tended to only consider negative emotions. We would like to find out more about this aspect of borderline personality disorder and we are asking for your help. By conducting this research we hope to better understand the difficulties and improve the support that can be offered in the future.

Do I have to take part?

It is up to you to decide. We will describe the study and go through this information sheet, which we will then give to you. We will then ask you to sign a consent form to show you have agreed to take part. You are free to withdraw at any time, without giving a reason. This would not affect the care you receive at XXX.

What will happen to me if I take part?

It is up to you to decide whether to take part or not. If you agree to take part in this study you will be given this information sheet to keep and you will be asked to sign a consent form and fill in a brief personal information sheet. The researcher will then ask you ask you a number of questions about your past and present difficulties, which could take up to an hour. On another day you will be asked to complete three short questionnaires about your emotions. You will then be shown a number of photos and asked to indicate how

emotional they make you feel. This should take no longer than 20 minutes of your time. The interview and the questionnaires will take place at XXX at a time that suits you. If you decide to take part you are still free to withdraw at any time without having to give a reason. Your decision to take part or not will not affect the care you are currently receiving.

Some participants may also be asked to take part in the second stage of the study. This involves using advanced brain scanning equipment to look at the activity in the brain while viewing emotional pictures. This equipment is at the XXX. Potential participants will be able to visit XXX with a member of the clinical team from XXX before deciding whether to take part. On another day participants will be asked to view the pictures rated in the first stage while in the brain scanners, which should take about two hours. Not all participants will be asked if they wish to take part in the second stage of the study, and those who do decide to take part are still free to withdraw at any time without having to give a reason.

What are the possible disadvantages and risks of taking part?

It is possible that some of the questions in the initial interview might arise painful feelings in you. Also some of the pictures you will be asked to rate have been chosen to trigger negative emotions, such as sadness. However, these negative images have been carefully selected so as to be no worse than anything you might see in a news report, and were approved by a pilot study with previous XXX clients. If you experience some distress at any time the researcher will discuss this with you and with your approval report relevant matters to the clinical team.

Participants who agree to go on to the scanning stage of the study may also find the brain scan procedure to be strange or uncomfortable. The scanning does not involve any physical pain or radiation, and works with small magnetic fields around the head. The procedure will be fully explained to any participant asked to go on to this stage. Potential participants will be able to visit the XXX before agreeing to take part, and are free to withdraw at any time.

What are the possible benefits of taking part?

We cannot guarantee or promise that you will receive any immediate benefits from this study. Although no benefits are promised we hope that the information we get from this study will increase understanding and help improve the treatment of people with borderline personality disorder.

Will my taking part in the study be kept confidential?

Yes. We will follow ethical and legal practice and all information about you will be handled in confidence. All information which is collected about you during the course of the research will be kept strictly confidential, and will not be traced back to your clinical notes to which the researcher will have no access. The only exception to this is if you were to disclose information that suggested that you or somebody else was at serious risk of harm. In these

circumstances this would be discussed with you further and the information would be communicated to the clinical team on XXX. All of the data collected will be assigned an identifying number and your name will be removed before it leaves XXX so that you cannot be identified from the information. The information will be retained for no longer than 5 years, after which time it will be disposed of securely. Any brain scan data may be retained longer by staff at XXX for future studies, but your consent will be sought before the data is used again.

What will happen to the results of the research study?

The findings of the study will be presented at a research conference and it is hoped the study will be published in a scientific journal. Participants in the study will not be identified in any report or publication of the research. All participants will be kept informed of the progress of the study as it is happening. The findings will be presented by the researchers to all interested participants and a written summary provided.

Who is organising the research?

The research is a being carried out jointly by XXX and the XXX Trust that employs the Primary Researcher. The study is being undertaken by the Primary Researcher as part of a professional qualification in Clinical Psychology. None of the people involved in the study will be doing so for any monetary gain over their usual salary.

Who has reviewed the study?

All research in the NHS is looked at by an independent group of people, called a Research Ethics Committee (REC) to protect your safety, rights, well-being and dignity. This study has been reviewed and given favourable opinion by the Local REC and the XXX Research Governance procedure.

Thank you for taking time and reading this information sheet.

If you wish for more information about this study please contact XXX

Appendix 6

Consent Form

CONSENT FORM

Title of Project: *Emotional Regulation in Borderline Personality Disorder*

I confirm that I have read and understand the Participant Information sheet dated..... (version….) for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily. YES NO

I understand that my participation is voluntary and that I am free to withdraw at any time without giving any reason, without my medical care or legal rights being affected. YES NO

I agree to take part in the above study. YES NO

Signed.....

Date.....

NAME IN BLOCK CAPITALS.....

RESEARCHER

I have explained the study to the participant and have answered any questions regarding it.

Signed.....

Date.....

NAME IN BLOCK CAPITALS.....

Appendix 7

Participant Information Form

Participant Information

Name: .....

Today's date: .....

Age: .....

Marital status: .....

Race/ethnic group: .....

Employment status: .....

Highest level of education: .....

Medications:

Name	Dose

Appendix 8

Questionnaires

Affect Intensity Measure

The following questions refer to emotional reactions to typical life events. Please indicate how **you** react to these events by placing a number from the following scale in the box preceding each item. Please base your answer on how **you** react, *not* on how you think others react or how you think a person should react.

Never	Almost never	Occasionally	Usually	Almost always	Always
1	2	3	4	5	6

1		When I accomplish something difficult I feel delighted or elated.
2		When I feel happy it is a strong type of exuberance.
3		I enjoy being with people very much.
4		I feel pretty bad when I tell a lie.
5		When I solve a small personal problem, I feel euphoric.
6		My emotions tend to be more intense than those of most people.
7		My happy moods are so strong that I feel like I'm in heaven.
8		I get overly enthusiastic.
9		If I complete a task I thought was impossible, I am ecstatic.
10		My heart races at the anticipation of some exciting event.
11		Sad movies deeply touch me.
12		When I'm happy it's a feeling of being untroubled and content rather than being zestful and aroused.
13		When I talk in front of a group for the first time my voice gets shaky and my heart races.
14		When something good happened, I am usually much more jubilant than others.
15		My friends might say that I'm emotional.
16		The memories I like the most are of those times when I felt content and peaceful rather than zestful; and enthusiastic.
17		The sight of someone who is hurt badly affects me strongly.
18		When I'm feeling well it's easy for me to go from being in a good mood to being really joyful.
19		"Calm and cool" could easily describe me.

Never	Almost never	Occasionally	Usually	Almost always	Always
1	2	3	4	5	6

20		When I'm happy I feel like I'm bursting with joy.
21		Seeing a picture of some violent car accident in a newspaper makes me feel sick to my stomach.
22		When I'm happy I feel very energetic.
23		When I receive an award I become overjoyed.
24		When I succeed at something, my reaction is calm contentment.
25		When I do something wrong I have strong feelings of shame and guilt.
26		I can remain calm even on the most trying days.
27		When things are going good I feel "on top of the world."
28		When I get angry it's easy fro me to still be rational and not overreact.
29		When I know I have done something very well, I feel relaxed and content rather than excited and elated.
30		When I do feel anxiety it is normally very strong.
31		My negative moods are mild in intensity.
32		When I am excited over something I want to share my feelings with everyone.
33		When I feel happiness, it is a quiet type of contentment.
34		My friends would probably say I'm a tense or "high-strung" person.
35		When I'm happy, I bubble over with energy.
36		When I feel guilty, this emotion is quite strong.
37		I would characterise my happy moods as closer to contentment than to joy.
38		When someone compliments me, I get so happy I could "burst."
39		When I am nervous I get shaky all over.
40		When I am happy the feeling is more like contentment and inner calm than one of exhilaration and excitement.

Thank you for your time.

Affective Control Scale

Please rate the extent of your agreement with each of the statements below by placing a number from the following scale in the box preceding each item.

Very strongly disagree	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Very strongly agree
1	2	3	4	5	6	7

1		I am concerned that I will say things I'll regret when I get angry.
2		I can get too carried away when I am really happy.
3		Depression could really take me over, so it is important to fight off sad feelings.
4		If I get depressed, I am quite sure that I'll bounce right back.
5		I get so rattled when I am nervous that I cannot think clearly.
6		Being filled with joy sounds great, but I am concerned that I could lose control over my actions if I get too excited.
7		It scares me when I feel "shaky" (trembling).
8		I am afraid that I will hurt someone if I get really furious.
9		I feel comfortable that I can control my level of anxiety.
10		Being really happy is scary for me because I am afraid of losing control.
11		If people were to find out how angry I sometimes feel, the consequences might be pretty bad.
12		When I feel good, I let myself go and enjoy it to the fullest.
13		I am afraid that I could go into a depression that could wipe me out.
14		When I feel really happy, I go overboard, so I don't like getting overly ecstatic.
15		When I get nervous, I think that I am going to go crazy.
16		I feel very comfortable in expressing angry feelings.
17		I am able to prevent myself from becoming overly anxious.
18		No matter how happy I become, I keep my feet firmly on the ground.
19		I am afraid that I might try to hurt myself if I get too depressed.
20		It scares me when I am nervous.
21		Being nervous isn't pleasant, but I can handle it.

Very strongly disagree	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Very strongly agree
1	2	3	4	5	6	7

22		I love feeling excited - it is a great feeling.
23		I worry about losing self-control when I am on 'cloud nine'.
24		There is nothing I can do to stop my anxiety once it has started.
25		When I start feeling 'down', I think I might let the sadness go too far.
26		Once I get nervous, I think that my anxiety might get out of hand.
27		Being depressed is not so bad because I know it will soon pass.
28		I would be embarrassed to death if I lost my temper in front of other people.
29		When I get 'the blues', I worry that they will pull me down too far.
30		When I get angry, I don't particularly worry about losing my temper.
31		Whether I am happy or not, my self-control stays about the same.
32		When I get really excited about something I worry that my enthusiasm will get out of hand.
33		When I get nervous, I feel as if I am going to scream.
34		I get nervous about being angry because I'm afraid I will go too far, and I'll regret it later.
35		I am afraid that I will babble or talk funny when I am nervous.
36		Getting really ecstatic about something is a problem for me because sometimes being too happy clouds my judgement.
37		Depression is scary to me - I am afraid that I could get depressed and never recover.
38		I don't really mind feeling nervous: I know it's just a passing thing.
39		I am afraid that letting myself feel really angry about something could lead me into an unending rage.
40		When I get nervous, I am afraid that I will act foolish.
41		I am afraid that I'll do something dumb if I gat carried away with happiness.
42		I think my judgement suffers when I get *really* happy.

Thank you for your time.

Hospital Anxiety and Depression Scale

Instructions: Clinicians are aware that emotions play an important part in most illnesses. If your clinician knows about these feelings he or she will be able to help you more. This questionnaire is designed to help your clinician know how you feel. Read each item and place a firm tick in the box opposite the reply which comes closest to how you have been feeling in the past week. Don't take too long over your replies: your immediate reaction to each item will probably be more accurate than a long thought out response.

I feel tense or 'wound up':		**I feel as if I am slowed down:**	
Most of the time	3	Nearly all of the time	3
A lot of the time	2	Very often	2
Time to time, occasionally	1	Sometimes	1
Not at all	0	Not at all	0

I still enjoy the things I used to enjoy:		**I get a sort of frightened feeling like 'butterflies in the stomach':**	
Definitely as much	0	Not at all	0
Not quite so much	1	Occasionally	1
Only a little	2	Quite often	2
Not at all	3	Very often	3

I get a sort of frightened feeling like something awful is about to happen:		**I have lost interest in my appearance:**	
Very definitely and quite badly	3	Definitely	3
Yes, but not too badly	2	I don't take as much care as I should	2
A little, but it doesn't worry me	1	I may not take quite as much care	1
Not at all	0	I take just as much care as ever	0

I can laugh and see the funny side of things:	
As much as I always could	0
Not quite so much now	1
Definitely not so much now	2
Not at all	3

I feel restless as if I have to be on the move:	
Very much indeed	3
Quite a lot	2
Not very much	1
Not at all	0

Worrying thoughts go through my mind:	
A great deal of the time	3
A lot of the time	2
From time to time but not too often	1
Only occasionally	0

I look forward with enjoyment to things:	
A much as I ever did	0
Rather less than I used to	1
Definitely less than I used to	2
Hardly at all	3

I feel cheerful:	
Not at all	3
Not often	2
Sometimes	1
Most of the time	0

I get sudden feelings of panic:	
Very often indeed	3
Quite often	2
Not very often	1
Not at all	0

I can sit at ease and feel relaxed:	
Definitely	0
Usually	1
Not often	2
Not at all	3

I can enjoy a good book or radio or TV programme:	
Often	0
Sometimes	1
Not often	2
Very seldom	3