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Attentional Bias in Later Stages of Emotional Information Processing in Female Adolescents with Borderline Personality Disorder

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Key Words
Borderline personality disorder · Attentional bias · Attentional maintenance · Emotional faces · Visual dot probe

Abstract
Background: Bias in emotional information processing has been described in patients with borderline personality disorder (BPD). This study investigates whether adolescent patients with a diagnosis of BPD demonstrate abnormalities in attentional maintenance in viewing emotional faces. ***Sampling and Methods:*** Thirty female adolescents with a diagnosis of BPD, 29 female adolescents with mixed psychiatric diagnoses, and 30 healthy participants were tested with the visual dot probe task. The task involved showing photographs of actors with faces depicting neutral, negative, and positive expressions for 1,500 ms each. ***Results:*** Attentional bias to negative faces was not generally associated with BPD, but patients with BPD did show a strong correlation between current mood and attentional bias to negative faces. Only in adolescents with BPD did attention to negative faces narrow when they were currently in a state of negative mood. Conversely, both control groups avoided negative faces in conjunction with a decline in positive mood. ***Conclusions:*** This study indicates that borderline pathology is linked to an inability to disengage attention from negative facial expressions during attentional maintenance when in a negative mood. Based on these findings, mood-dependent therapeutic interventions focusing on attentional processes may represent a useful add-on to established therapies in patients with BPD.

Rigid and poorly adapted affective responses are a central feature of personality disorders [1]. Borderline personality disorder (BPD), in particular, is thought to arise from emotion dysregulation, which is conceptualized as a combination of emotional vulnerability and inability to modulate emotional responses [2]. Emotional vulnerability is characterized by a marked sensitivity to emotional stimuli and unusually strong reactions that are slow in returning to baseline. According to Linehan [2], most of the symptoms exhibited by patients with BPD-like impulsive and self-injurious behaviors are either the direct or indirect consequence of emotional dysregulation or attempts to modulate intense emotional reactions.

Various authors [3–5] have emphasized the ability to control attention in contact with emotional stimuli (attentional control) in order to facilitate emotional regulation. Gross [6, 7] has distinguished 5 sets of such emotional regulation processes: situation selection, situation modification, attentional deployment, cognitive change, and response modulation. In this connection, attentional

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deployment means the individual's ability to adapt his/her own attention to modify emotions in a given situation. Furthermore, an initial investigation has provided an even stronger empirical basis for a causal association between attentional bias and emotional vulnerability [8]. These findings suggest that individuals who were trained to pay attention to negative words rather than neutral words show better emotional regulation than individuals without this ability. This again leads to the assumption that, in the context of their emotional dysregulation, patients with BPD show deficits in attentional control. Linehan [2] also stressed the impact of pronounced oscillations from emotional baseline on attentional processes. In her point of view, patients with BPD show problems in disengaging attention from emotional stimuli because of their deficits in emotional regulation. However, she hypothesized that biased information processing is mood-dependent and that every person who is highly emotionally aroused shows deficits in attentional control.

There is a large body of evidence regarding attentional bias to emotionally relevant stimuli in a number of psychiatric disorders. For example, previous studies demonstrated that patients with anxiety disorders such as generalized anxiety disorder [9], social phobia [10], and posttraumatic stress disorder show attentional bias to threatening stimuli [11]. Depression, therefore, is not reliably associated with attentional bias to 'depressive or threatening words', but rather with biases in later stages of information processing such as the selective recall of negative information [12, 13]. Similarly to individuals with affective disorders, there might be an attentional bias toward negative rather than positive information in individuals with BPD [14].

Only few studies have investigated biased information processing in adults with BPD. Using the 'directed forgetting' paradigm, BPD patients showed impaired directed forgetting for borderline-specific negative stimuli, remembering more words which they were instructed to forget than healthy comparison subjects [15]. The authors reasoned that while elaborating and encoding borderline-relevant stimuli, patients with BPD potentially show deficits in inhibition processes instead of a general bias in information processing. Another study found a reduced inhibition in forgetting negative words in the 'directed forgetting' task and in the negative priming task, while no effect was found in the emotional Stroop task [14]. Significant correlations were reported between inhibitory functioning with both current affect and with trait anxiety and anger in the BPD group, specifically for negative stimuli. These findings argued for difficulties in actively suppressing irrelevant aversive information in patients with BPD. Another study explored attentional bias toward negative emotional stimuli with an emotional Stroop paradigm [16]. This study demonstrated that patients with BPD as well as patients with cluster C personality disorders showed an attentional bias caused by negative emotional words, whereas no bias was found in the healthy control group. Those results were interpreted as evidence for the presence of a relatively crude and non-borderline-specific 'hypervigilance' for any negative emotional stimulus in patients with BPD [16]. To summarize, previous research findings showed biased information processing in these patients regarding inhibition of irrelevant aversive stimuli and attentional bias to negative emotional stimuli. Up to now no investigations have been conducted on information processing in adolescent patients with BPD. Indeed, this information may generate insights as to whether deficits on information processing already exist in the early stages of BPD development. Although the validity of the diagnosis of BPD for adolescents has been discussed controversially, recent studies have revealed that the diagnosis of BPD in adolescent inpatients can reliably be assessed and has good concurrent validity [17].

We proposed that deficient emotional regulation in BPD interferes with attentional processing of negative emotional stimuli in adolescents with BPD. We used the visual dot probe paradigm and emotional facial expressions instead of words as stimuli. As initial orienting (emotional Stroop paradigm) and memory functions (directed forgetting paradigm) have been investigated in previous studies [15, 16], the present one focuses on attentional maintenance in processing emotional stimuli. We hypothesized that patients with BPD would show an attentional bias to negative emotional stimuli but not to positive emotional stimuli. Moreover, because of the possible impact of emotional arousal on information processing, we investigated the relationship between current mood and attentional bias.

Methods

Participants and Procedure

Participants were young women between 13 and 19 years of age without a psychotic disease, pervasive developmental disorder, alcohol/drug dependence, significant neurological disease, or impaired vision and with a full-scale IQ above 85 as measured by the German version [18] of the Wechsler Abbreviated Scale of Intelligence. The young women comprised three groups: patients with BPD (n = 30), patients with mixed psychiatric diagnoses who did not exhibit another cluster B personality disorder or fulfill any of the borderline criteria as clinical control group (n = 29), and healthy volunteers who had never received a psychiatric diagnosis or undergone any psychological or psychiatric treatment (i.e., received psychotropic medication) in their lifetime (n = 30).

Patients were consecutively recruited at the Department of Child and Adolescent Psychiatry of the University of Heidelberg where they were either inpatients or outpatients. The patients were informed about the study by their attending physicians. Healthy comparison subjects were recruited through advertisements in public schools. All patients who were suspected of having a BPD were included in the screening to confirm the diagnosis. If the diagnosis was confirmed, the patients were included in the experiment. Patients without BPD and healthy comparison subjects who fulfilled the criteria for the clinical or healthy control group were matched by age and IQ. The study was approved by the Ethics Committee of the Faculty of Medicine. Adolescent subjects provided written assent and legal guardians provided written informed consent after study procedures were fully explained. Clinical and neuropsychological measurements were carried out at three separate appointments during a time period of 2 weeks at the Research Center of the Department of Child and Adolescent Psychiatry.

Measures

Axis I diagnoses were surveyed with the German version [19] of the semi-structured diagnostic interview of the Schedule for Affective Disorders and Schizophrenia for School-Age Children – Present and Lifetime Version [20, 21]. Axis II diagnoses were assessed by using the German version [22] of the Structured Clinical Interview for DSM-IV Axis II Personality Disorders [23]. The interviews were conducted with each adolescent by a trained child psychiatrist and tape-recorded. The reliability of BPD diagnosis was assessed by a second rating of 10 randomly selected audiotaped interviews by a trained psychologist and was found to be excellent (Cohen's kappa = 1).

The German version [24] of the Children's Global Assessment Scale [25] was used to measure the overall psychosocial functioning of the participants. The general extent of psychopathology was assessed by using the Global Severity Index (GSI) from the German version [26] of the Symptom Checklist SCL-90-R [27]. Reports of depressive symptoms were evaluated with the German version [28] of the Children's Depression Inventory [29, 30]. To measure the degree of social fears, the participants filled out the German version [31] of the Social Phobia and Anxiety Inventory for Children [32–34].

To determine the attentional bias, the visual dot probe paradigm was used. With this paradigm, it is assumed that participants react faster to visual cues in an attended area than in an unattended area [9], and therefore spatial attention can be measured by the reaction time to visual cues [35, 36]. Both this paradigm and the stimuli applied have been successfully employed in adults [37, 38]. The stimuli were presented on a computer monitor in a darkened room. Subjects sat at a 87.5-cm distance from the monitor to ensure a parafoveal presentation of the facial expressions. Experimenters were blinded to group assignment. Before data collection, the participants specified their current mood by answering the question 'How do you feel at this moment?' on a 100-mm visual analog scale ranging from 0 (very good) to 100 (very bad).

The task relied on pairs of photographs from different actors, each presenting two facial expressions: one neutral and the other either negative (angry, anxious, sad, or disgusting) or positive (happy). The photographs were extracted from the Ekman and Friesen [39] series of facial expressions. Photographs of 4 women and 4 men, with every individual exhibiting each of the 5 emotional expressions and 1 neutral expression, comprised the stimulus set of 48 pictures. Each of the 40 emotional pictures (positive or negative) was paired with the neutral expression of the same actor, resulting in 40 pairs of pictures.

The task began with 32 trials of neutral stimuli. First, a fixation cross was presented centrally for 500 ms, which was followed by two stars that were visible for 1,500 ms. Immediately thereafter, a 'dot probe' composed of two points, one upon the other or side by side, was presented at the left or right side of the screen. Subjects were instructed to press one of two keys as quickly and as accurately as possible to indicate the form of the probe. The intertrial interval was equivalent to the reaction time of the participant. The neutral trials served to collect data about attentional performance to non-emotional stimuli. Subsequent to the neutral trials, 320 experimental trials were presented in random order. For these experimental trials, pairs of pictures from the same actor, instead of stars, were presented on the screen for 1,500 ms. This stimulus duration allows for multiple gaze shifts and is therefore sensitive for later stages of attentional processing or attentional maintenance [40]. These trials included 160 negative emotional trials and 160 positive emotional trials. One half of the trials displayed the emotional expression on the right and the other half displayed the emotional expression on the left.

Analysis

As described in earlier studies [9, 41], the trials with erroneous responses were discarded. Because latencies of less than 100 ms are too fast to be considered a real reaction to the stimuli [42], they were also discarded. Error rates are presented in table 1. Less than 1% of the trials involved latencies of less than 100 ms. Because of their insensitivity to outliers, we preferred working with reaction time medians instead of means.

We commenced this study with clear a priori hypotheses based on previous data relating clinical measures to measures of attentional bias to emotional stimuli. As a result, analyses were based on derived measures of attentional bias. These were calculated using a standard formula that subtracts, for each participant, the mean reaction time in trials in which the emotional face and probe appeared on the same side of the display from the mean reaction time in trials in which the emotional face and probe appeared on the opposite side of the display [11, 43]. Positive bias scores reflect the propensity to monitor the emotional (positive or negative) stimulus, and negative bias scores reflect the tendency to avoid the (positive or negative) emotional stimulus.

Group characteristics between all groups were compared using analysis of variance, whereas group characteristics between the clinical groups were compared by independent-samples t tests. To test the first hypothesis, the groups were compared by analysis of variance. The secondary hypothesis was tested by analysis of covariance with current mood and the interaction between group and mood as covariate. When there is a significant interaction between group and current mood, group factor and current mood cannot be evaluated independently of each other because group differences vary according to the status of current

Table 1. Demographic and clinical characteristics for 30 female adolescents with BPD, 29 female adolescents with mixed psychiatric diagnoses, and 30 healthy comparison subjects

	Patients with BPD	Patients with mixed psychiatric diagnoses	Healthy comparison subjects	Analysis	
				F(2, 86)	p
Age, years	16.13 ± 1.48	15.31 ± 1.11	15.73 ± 1.46	2.69	0.07
IQ (Wechsler Abbreviated Scale of Intelligence)	109.73 ± 9.12	106.86 ± 6.60	108.53 ± 9.25	0.86	0.43
Children Global Assessment Scale[1]	50.50 ± 10.61	60.90 ± 13.75	100.00 ± 0.00	204.73	<0.001
GSI[1]	1.12 ± 0.64	0.60 ± 0.52	0.22 ± 0.14	26.43	<0.001
Depression Inventory for Children and Adolescents[1]	24.90 ± 9.43	14.56 ± 9.02	9.18 ± 4.21	30.63	<0.001
Social Phobia and Anxiety Inventory for Children[2]	18.39 ± 11.58	11.22 ± 9.84	8.09 ± 6.06	9.24	<0.001
Current mood at visual dot probe[3]	39.5 ± 24.9	29.3 ± 20.8	19.9 ± 14.7	6.82	<0.01

[1] All groups differed significantly from each other in post hoc comparisons.
[2] Subjects with BPD differed significantly from the other two groups in post hoc comparisons.
[3] Subjects with BPD differed significantly from the healthy subjects in post hoc comparisons.

mood. Therefore, we calculated group differences at defined mood scores. If a significant interaction was absent, the evaluation was carried out by analysis of covariance with only current mood as covariate. This is intended to ensure a better interpretation of the group means. An α level of 0.05 was used for all statistical tests.

Results

Characteristics of the Subjects

Table 1 summarizes the characteristics of the subjects. As shown in table 1, female adolescents with BPD exhibited lower psychosocial functioning (Global Assessment Scale), a higher extent of general psychopathology (GSI), a higher extent of depressive symptoms, and a higher extent of symptoms of social anxiety. Because of the missing correlation between bias score and Global Assessment Scale ($r = 0.06$, $p = 0.59$), GSI ($r = 0.06$, $p = 0.59$), depression ($r = 0.07$, $p = 0.52$), and social anxiety ($r = 0.001$, $p = 0.99$), the variables were not included as covariates in the statistical models. Five patients with BPD and 3 patients without BPD were taking psychotropic medications. Since results were similar when these participants were excluded, data from these participants were retained in the statistical models.

In addition to the borderline diagnosis, all of the patients with BPD had at least one axis I psychiatric diagnosis (see table 2 for axis I diagnoses of the two clinical groups). The mean number of axis I psychiatric diagnoses in patients with BPD was 2.57 (SD = 1.10, range = 1–6). The mean number of axis I psychiatric diagnoses in the patients with mixed psychiatric diagnoses was significantly lower than in the patients with BPD [mean = 1.55, SD = 0.63, range = 1–3; $t(57) = -4.31$, $p < 0.001$].

Table 2. Current axis I diagnoses for 30 female adolescents with BPD and 29 female adolescents with mixed psychiatric diagnoses (multiple diagnoses per subject possible)

	BPD		Mixed psychiatric diagnoses	
	n	%[a]	n	%[a]
Disruptive behavior disorders	4	5.2	–	–
Substance use disorders	8	10.4	–	–
Depressive disorders	21	27.3	17	37.7
Anxiety disorders	9	11.7	9	20.0
Somatoform disorders	2	2.6	1	1.3
Dissociative disorders	17	22.1	6	13.3
Eating disorders	14	18.2	10	22.2
Impulse control disorders	1	1.3	–	–
Adjustment disorders	1	1.3	2	2.6

[a] Percent of total axis I diagnoses of the group (n = 77 in patients with BPD, n = 45 in patients with mixed psychiatric disorders).

Among the adolescents with BPD, most of the patients satisfied between 5 (n = 13, 43.3%) and 6 (n = 14, 46.7%) diagnostic criteria for the borderline diagnosis (mean = 5.73, SD = 0.83). Only 3 patients (10%) fulfilled more than 6 criteria. The patients with BPD primarily satisfied the criteria for behavioral and affective instability such as

Table 3. Results of the visual dot probe for 30 female adolescents with BPD, 29 female adolescents with mixed psychiatric diagnoses, and 30 healthy comparison subjects

Characteristic	Patients with BPD (n = 30)		Patients with mixed psychiatric diagnoses (n = 29)		Healthy comparison subjects (n = 30)	
	mean[1]	SD	mean[1]	SD	mean[1]	SD
Neutral trials						
RT, ms	521.80	84.48	481.29	66.50	517.82	70.04
Errors, n	2.17	2.38	2.07	2.14	2.47	3.20
Visual dot probe						
RT, ms	569.50	81.18	526.95	73.35	545.25	62.92
Errors, n	10.07	8.34	9.97	8.14	11.07	8.78
Bias score						
Negative stimuli	3.16	18.38	−0.48	14.54	3.48	11.43
Positive stimuli	−0.60	26.01	−4.65	26.85	2.20	27.26

RT = Reaction time.
[1] Mean of individual medians of attentional bias scores (stimulus duration: 1,500 ms) in the three groups.

self-injury, impulsivity, and mood fluctuations (>80%). In contrast, interpersonal instability and abandonment anxiety were relatively rare (<40%).

Attentional Bias

With regard to performance in the neutral trials and experimental trials, no group differences emerged in reaction time [neutral trials: $F(2, 86) = 2.66$, $p = 0.08$; experimental trials: $F(2, 86) = 2.54$, $p = 0.09$] or concerning error rates in probe location identification [neutral trials: $F(2, 86) = 0.19$, $p = 0.83$; experimental trials: $F(2, 86) = 0.16$, $p = 0.86$]. However, group differences did emerge in current mood before the visual dot probe between patients with BPD and healthy volunteers (table 1).

Attentional bias score regarding negative emotional stimuli is shown in table 3. The first hypothesis could not be proven. The analysis of variance showed no group differences in attentional bias to negative emotional stimuli [$F(2, 86) = 0.63$, $p = 0.54$]. The examination of the secondary hypothesis showed an influence of current mood on attentional bias, which is different for the study groups. The analysis of covariance indicated a significant interaction between current mood and the group factor [$F(2, 83) = 11.64$, $p < 0.0001$]. Therefore, the findings from the covariate [$F(1, 83) = 0.00$, $p = 0.98$] cannot be evaluated independently of the group factor and have no explanatory power. We calculated group differences at defined mood scores to exemplify the influence of the mood score on group differences in attentional bias. The calculation of group differences at defined mood scores showed significant differences with respect to positive mood (actual mood score = 10), neutral mood (actual mood score = 50), and negative mood (actual mood score = 70). Patients with BPD showed significantly greater avoidance of negative emotional stimuli when in a positive mood than patients without BPD [$F(1, 83) = 7.06$, $p = 0.01$] or healthy volunteers [$F(1, 83) = 11.55$, $p = 0.001$]. When in a neutral mood, patients with BPD exhibited a significantly greater focus on negative emotional stimuli than patients without BPD [$F(1, 83) = 7.95$, $p = 0.006$] and healthy volunteers [$F(1, 83) = 3.93$, $p = 0.05$]. When in a negative mood, patients with BPD also exhibited a significantly greater focus on negative emotional stimuli than patients without BPD [$F(1, 83) = 14.22$, $p = 0.0003$]. Because all healthy volunteers showed positive or neutral mood, patients with BPD and healthy controls were not compared in negative mood. Regression straight lines of attentional bias to negative stimuli are provided in figure 1 for the three experimental groups regarding the current mood.

Attentional bias score regarding positive emotional stimuli is also shown in table 3. The analysis of variance did not show any group differences in attentional bias to positive emotional stimuli either [$F(2, 86) = 0.49$, $p = 0.62$]. Therefore, the first hypothesis cannot be proven. The analyses for the secondary hypothesis showed that the interaction between current mood and the group factor was not significant [$F(2, 83) = 0.96$, $p = 0.39$]. Due to the missing interaction between current mood and group factor, the group differences were analyzed by analysis of covariance with current mood as covariate. Current

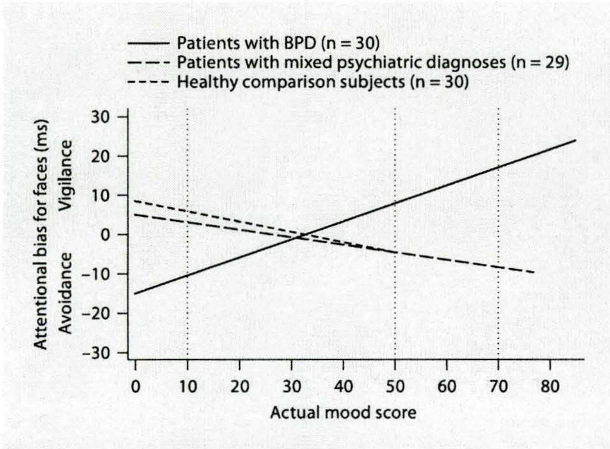

Fig. 1. Regression of attentional bias to negative cues in patients with BPD, patients with mixed psychiatric diagnoses, and comparison subjects taking into account their current mood. Attentional bias for faces: positive bias scores reflect the tendency to monitor the negative emotional stimulus; negative bias scores reflect the tendency to avoid the negative emotional stimulus. Actual mood score: visual analog scale from very good to very bad. Vertical dotted lines represent defined mood scores for conducted group comparisons.

mood as covariate was not significant [$F(2, 85) = 0.50$, $p = 0.48$]. For this reason, the secondary hypothesis could not be proven either.

Discussion

To the best of our knowledge, this is the first study using the visual dot probe in patients with BPD and the first to analyze distortions in attentional maintenance of emotional stimuli in adolescents with BPD. To summarize the major findings, no general group differences in attentional bias to negative emotional stimuli were found when current mood was not taken into account. We found an interaction between current mood and hypervigilance to negative emotional stimuli in female adolescents with BPD. Attentional bias to negative emotional stimuli was found when patients with BPD were in a negative mood. When patients with BPD were in a positive mood, they displayed an avoidance of negative emotional stimuli. Both control groups showed a more reverse pattern. This may indicate that the findings do not represent a common, nonspecific effect of the actual state, but rather a borderline-specific effect. A further interesting finding is the unimpaired reaction to positive emotional stimuli in patients with BPD. Female adolescents with BPD neither displayed distortions in attentional processes nor associations between current mood and attentional bias to positive emotional stimuli, which is in contrast to the findings of Sieswerda et al. [44]. In that study evidence was found for attentional bias to positive words. This contradictory result may be explained by the use of different paradigms that tested different phases of attentional focus (early vs. late stages). However, the different findings may be due even more to the use of different stimuli. Our findings may strengthen the assumption that emotional dysregulation in BPD is linked with the processing of negative emotional faces rather than with the processing of emotional stimuli in general.

Previous studies of BPD found a crude 'hypervigilance' to any negative emotional stimuli [16] and a failure in inhibition while encoding and elaborating borderline-specific words, but not with positive words [15]. If current mood of the patients in those studies was predominantly negative, the findings are consistent with our results. This highlights the importance of accounting for current mood in subsequent studies about information processing in BPD. It seems important to mention that in our investigation actual mood and not depression moderates attentional bias to negative emotional stimuli in patients with BPD. The finding that attentional bias to negative emotional stimuli in patients with BPD is influenced by a state rather than trait mood factor should be confirmed in further studies.

Our findings can be interpreted in the context of the dialectic-behavioral theory of BPD. Linehan [2] hypothesized that attentional bias to emotional stimuli is the effect of emotional arousal rather than a specific characteristic of patients with BPD. Our findings suggest that patients with BPD do not show a stronger reaction to emotional stimuli as a result of their high emotional arousal and pronounced emotional vulnerability. Instead, information processing of negative emotional stimuli in patients with BPD seems to be elementarily different from that in patients with other psychiatric disorders and healthy human beings. When in a negative mood, patients with BPD may have difficulty disengaging attention from negative emotional stimuli. That might aggravate negative mood and develop into a vicious circle. Patients with BPD might not be able to control their attention in negative mood and avoid negative emotional stimuli to regulate their emotions. It may be postulated that deficits in attentional control, especially the mood-dependent reduced ability to disengage from negative emotional stimuli, cause inhibition deficits of borderline-relevant stimuli as revealed in the investigation conducted by Korfine and Hooley [15]. If our findings can be confirmed, the concept of emotional vulnerability and emotional dysregulation should be enhanced by mood-dependent and borderline-specific processes of selection and attention relating to negative emotional stimuli.

To ensure that the borderline pathology in our study is representative of the population served by a typical university clinic for child and adolescent psychiatry, the clinical groups were recruited consecutively from the clinical setting. Moreover, the investigation of a clinical control group provides evidence for the specificity of the findings for patients with BPD. A limitation to our study is the fact that all subjects were female and adolescent, which represents a restriction for generalizing our results. The fact that current mood was only assessed by a visual analog scale and was not an independent variable under the control of the experimenter (mood induction) limits causal interpretation of the results.

Conclusions

This study should stimulate subsequent research on neuronal aspects of attentional bias and its relation to BPD. Previous studies in adults have provided evidence for an enhanced amygdala activation in BPD when viewing standardized, emotionally aversive slides [45]. With regard to this finding it may be assumed that the visual cortex of patients with BPD may be modulated through the amygdala, increasing attention to emotionally relevant environmental stimuli. Future research might examine these associations by using neuroimaging methods. Therefore, the current paradigms could be used to generate insights into the relationships between mood-dependent attention, BPD, and underlying dysfunction in neural systems engaged by negative emotional stimuli. Moreover, future studies might consider the effects of mood induction on attentional bias.

The heightened processing of negative stimuli in a negative mood might impair the current mood of patients with BPD and become a vicious circle. Furthermore, the avoidance of negative facial expressions while in a positive mood may promote dysfunctional social interactions by impairing recognition of important emotional stimuli. This then might provoke stronger emotional reactions in others and an escalation of interpersonal interactions. As a consequence, the current mood of the patient might deteriorate and activate dysfunctional efforts to regulate his/her own emotions. Abnormalities in attentional processes help maintain borderline pathology, which offers potential for novel therapeutic options. Along this line, therapeutic interventions with the aim to influence attentional processes represent a useful complement to established therapies in patients with BPD. One possibility would be to use techniques that modify or control attentional processes [46], such as an attentional retraining that teaches patients to counteract the engagement of attention to negative stimuli and adopt an avoidant attentional style [13]. Interventions to reevaluate negative emotional cues could also be considered reasonable and helpful [47]. These interventions should be adopted when patients with BPD are in a negative mood. When in a positive mood, patients with BPD should additionally be instructed to pay attention to negative emotional cues in the social environment. In doing so, patients could learn to react in a functional manner and avert escalating interactions. Such treatments might specifically target underlying abnormalities in attention as a means of affecting social functioning and improving emotional regulation.

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