Effects of the dialectical behavioral therapy-mindfulness module on attention in patients with borderline personality disorder

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A B S T R A C T

It is known that patients with borderline personality disorder (BPD) show attention deficits and impulsivity. The main aim of this study was to explore the effects of Dialectical Behavioral Therapy-Mindfulness training (DBT-M), used as an adjunct to general psychiatric management (GPM), on attention variables in patients diagnosed with BPD. A second objective was to assess the relation of mindfulness formal practice on clinical variables. A sample of 60 patients with BPD was recruited. Forty of them were allocated to GPM – DBT-M treatment and the other 20 received GPM alone. At the termination of the mindfulness training, DBT-M – GPM group showed a significant improvement on commissions, hit reaction time, detectability scores from the CPT-II neuropsychological test, and also on the composite scores of inattention and impulsivity. Further, the more minutes of mindfulness practice were correlated to greater improvement in general psychiatric symptoms and affective symptomatology, but not in CPT-II measures. This is probably the first study so far assessing the effects of this single DBT module in patients with BPD. The results suggest a positive effect of such intervention on attention and impulsivity variables.

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Introduction

Borderline Personality Disorder (BPD) is characterized by a pervasive pattern of impulsivity, unstable affect, interpersonal dysfunctioning, and identity instability (American Psychiatric Association, 2001; Leichsenring, Leibing, Kruse, New, & Leweke, 2011). This fact results in a major public health problem that affects approximately 2% of individuals and causes significant adverse consequences for individuals, families, and society (Bornovalova, Lejuez, Daughters, Rosenthal, & Lynch, 2005). It is hypothesized that the etiological factors of this disorder are both biological vulnerability and environmental events, such as adverse childhood experiences (Linehan, 1993a).

Dialectical Behavioral Therapy (DBT) is one of the psychosocial interventions developed specifically for the treatment of BPD and has been proven effective in several well-controlled clinical outcome studies (Bohus et al., 2004; Koons et al., 2001; Linehan, Armstrong, Suárez, Allmon, & Heard, 1991; Linehan et al., 1999, 2006; McMain et al., 2009; Verheul et al., 2003). All previous studies have shown that DBT treatment consistently achieves clinical improvement, predominantly indicated by a decrease in self-harming and parasuicidal behavior, less time in hospital, lower depression and hopelessness and higher overall social functioning (Herpertz et al., 2007).

The standard DBT procedure (Linehan, 1993a, 1993b) includes four modes of intervention: group therapy, individual psychotherapy, phone calls, and consultation team meeting. The group component consists of approximately 2 h a week of skills coaching, aiming at increasing behavioral capabilities, an approach that has been already used alone (Soler et al., 2001, 2005, 2009). These skills are divided into four modules: Interpersonal Effectiveness, Emotion Regulation, Distress Tolerance and Mindfulness. A recent study that examined the type and frequency of skills practiced by patients with DBT found that mindfulness skills, along with Distress tolerance skills, were the most commonly practiced by the patients in standard DBT treatment (Lindenboim, Comtois, & Linehan, 2007). A similar study of skill usage found that mindfulness techniques were the most common skills used, reaching up to 44% of skills usage (Stepp, Epler, Jahng, & Trull, 2008). Mindfulness has a central role in DBT-Skills Training (DBT-ST), which is why it is called “core mindfulness skills” and embedded in all other modules (Linehan...
compared to a mindfulness novice control group (Slagter et al., 2007). Chiesa et al. (2011) summarized the current evidence of the effects of mindfulness on cognitive abilities in a recent review. Improvements in selective and executive attention may already be associated to early trainings on focused attention, whereas improvements in unfocused sustained attention abilities may be related to later open-monitoring practices. However this preliminary evidence should be considered with caution due to methodological limitations, negative results, variations of design, and particular characteristics of samples or duration of interventions.

The aim of the present study was to assess whether DBT-Mindfulness training modifies attentional processing in patients with BPD. Attention variables were examined by the Continuous Performance Test-II (CPT-II; Conners, 2000). We hypothesized that mindfulness training would improve sustained attention. In addition, the influence of mindfulness practice in clinical and cognitive outcomes is investigated, to determine whether the more formal practice the better outcomes in attention and clinical symptoms.

**Method**

**Participants**

Sixty-eight patients were invited to participate and a total of 60 patients were recruited from outpatient facilities of BPD Unit of the Department of Psychiatry from the Hospital de la Santa Creu i Sant Pau (from December 2009 to January 2011) and a final sample of 59 was used for analyses (one patient was withdrawn for invalid performance on CPT-II; see Fig. 1). Inclusion criteria consisted of: 1) meeting the DSM-IV diagnostic criteria for BPD as assessed by two semi-structured diagnostic interviews: the Structured Clinical Interview for DSM-IV Axis II Disorders (SCID-II; Gómez-Beneyto et al., 1994) and the Revised Diagnostic Interview for Borderlines (DIB-R; Barrachina et al., 2004); 2) age between 18 and 48 years; 3) no comorbidity with schizophrenia, drug-induced psychosis, organic brain syndrome, alcohol or other psychoactive substance dependence, bipolar disorder, mental retardation, or major depressive episode in course; 4) no current psychotherapy. Both SCID-II and DIB-R showed good psychometric properties with an internal reliability of 0.89 for DIB-R (Barrachina et al., 2004) and a satisfactory internal consistency reliability ranging between 0.71 and 0.94 for SCID-II as reviewed (Maelfeyt et al., 1997). All the interviews and evaluations were conducted by a trained psychologist (AF) with a wide experience in both screening interviews and clinical measures, who was blind to treatment arms.

All patients continued pharmacological therapy if it had been initiated prior to inclusion; type and dose of medication could not be however modified during the study period, or in the month before. Participants did not receive any other individual or group psychotherapy during the study. This study was approved by the Clinical Research Ethics Committee at the Hospital de la Santa Creu i Sant Pau and carried out in accordance with the Declaration of Helsinki. Participants were given a detailed description of the study and were asked to sign the written informed consent.

**Study design and procedure**

This was a single-center, non-randomized controlled trial with two treatment arms: DBT-Mindfulness training plus general psychiatric management (DBT-M + GPM) and GPM alone. Patients were assigned to the treatment arms on the basis of consecutive referral. Forty were allocated to DBT-M + GPM and 19 to GPM. The sample size of the DBT-M + GPM group (experimental group) was calculated to be double the size of the control group (GPM), in order to give robustness to the findings by assuring enough practitioners in the group of DBT-M + GPM, taking into account the low levels of...
motivation to practicing in patients with BPD (Dimidjian & Linehan, 2003). DBT-M + GPM consisted of eight psychotherapy sessions of 120 min each in groups of 9–11 participants. Each session followed the usual procedure in DBT-skills training, which includes teaching, in-session practice of new skills and homework assignments to practice these skills every week. These sessions were led by two cognitive behavioral psychotherapists with prior experience in skills training in BPD and trained in DBT by the “Behavioral Technology Transfer Group”. In addition, both therapists have been practicing daily meditation and attending periodically to retreats for more than 6 years.

Mindfulness skills were taught from the Mindfulness module. The aim of the module, specifically designed for patients with BPD, is to balance emotion with reasoning in order to achieve “wise mind”, to act with awareness and to decrease characteristic mood-dependent and impulsive behavioral patterns. The module is comprised by two different sets to be taught, named by Linehan as “what” skills and “how” skills. The first “what” skill teaches patients to simply observe (i.e. noticing and attending to the experience); the second instructs to describe, which implies the ability to apply verbal labels to what one has observed, i.e. events, thoughts, emotions and body sensations; and in the third “what” skill patients learn to fully participate in their actions in the current moment and without self-consciousness. “How” skills have to do with how to observe, how to describe and how to participate. These skills include: a) taking experiences in a non-evaluative manner (i.e. non-judgmental), b) focusing on one thing at a time and reorienting attention when distracted, and c) being effective, which means be oriented to non-mood-dependent goal in any a given situation (Linehan, 1993b).

In addition, some mindfulness skills were taken from the Distress Tolerance module, such as “Observing the breath”, “Half-smiling”, “Awareness” exercises and basic principles of accepting reality (“Radical acceptance”, “Turning the mind” and “Willingness

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**Fig. 1.** Flow diagram of selected patients for the study. BPD = Borderline Personality Disorder; SCID-II = Structured Clinical Interview for DSM-IV Axis II Disorders; DIB-R = Diagnostic Interview for Borderlines-Revised; CPT = Continuous Performance Test-II.
over Willfulness”). Contrary to the standard teaching of mindfulness in DBT, in this study patients were instructed to practice the skills acquired during each session at home, a common requirement of all other skills training modules. The length of time of the exercise depended on the patient’s criterion; participants were asked to choose a suitable time for each practice session and to adhere to this time. If unable to do so, they were told to comply with the following instruction “once you decide to finish the exercise, continue to practising it for at least one more minute, even if it is uncomfortable”. Scheduled formal exercises were reviewed and reinforced during the group sessions, like any other DBT-ST module. GPM was based on the commonly practiced clinical guidelines for BPD treatment that emphasize psychoeducation about BPD, focus on here-and-now problem solution, empathy and helping relationships. The treatment consisted of case management in regular visits (every 2–3 weeks) to give support to patients and their families.

**Measures**

1st hypothesis: attention outcomes between GPM group and DBT-M + GPM group

The main variable was assessed by means of CPT-II (Conners, 2000): a widely used computerized neuropsychological attention test. The test was administered to all participants within the week before interventions (GPM and DBT-M + GPM) and within the week after the end of them (10 weeks). In this test, letters appear one at a time on the computer monitor, and participants are required to press the “space” bar for each letter except the letter “X” as quickly and accurately as possible. The task includes six blocks, each with three 20-trial sub-blocks. Within the six blocks, each sub-block employs a different inter-stimulus interval (ISI): 1, 2, or 4 s. The order of the sub-blocks varies across the six main blocks of the task. Each letter is displayed for 250 ms. Several measures related to attention and impulsivity are obtained from this test: number of omissions (failure to respond to target), number of commissions (responses given to non-targets), hit reaction time (averaged from all correct responses), detectability (ability to distinguish between targets and non-targets), and perseverations (random, anticipatory or repeated responses without consideration of the stimuli or task requirements). Additionally, two more composite indexes were calculated to obtain a general measure of inattention and a measure of impulsivity (Riccio, Reynolds, Lowe, & Moore, 2002). The Inattention Index was calculated as follows:

\[ \text{Inattention} = \frac{\text{omissions} - \text{commissions}}{\text{omissions} + \text{commissions}} \]

and the Impulsivity Index:

\[ \text{Impulsivity} = \frac{1}{\text{Hit Reaction Time}^*}\left(\text{commissions/omissions}\right) \]

2nd hypothesis: clinical outcomes related to formal practice in DBT-M + GPM patients

The amount of formal mindfulness practice was obtained by averaging the number of minutes of practice/day during the last four weeks of the study period. Patients were asked to daily fill a form out with the minutes of formal practice, and in the beginning of each session they were required to give it to therapists. Patients were free to practice by hearing mp3 records or by following written instructions.

Psychopathological symptoms were assessed at the same occasions of CPT, pre- and post-intervention with the 17-item Hamilton Rating Scale-Depression (HRSD-17; Hamilton, 1960) for affective symptoms; the Brief Psychiatric Rating Scale (BPRS; Overall & Gorham, 1962) for general psychopathology symptoms; and the Profile of Mood States (POMS; McNair, Lorr, & Droppleman, 1971), which measures mood states: anger, depression, tension, fatigue, vigor, confusion, and an overall score. HRSD-17 shows an adequate reliability [most of the studies indicate a Cronbach’s alpha > 0.7 (Bagby, Ryder, Schuller, & Marshall, 2004)]; BPRS also has a good internal consistency [Cronbach’s alpha = 0.8 (Nicholson, Chapman, & Neufeld, 1995)]. The POMS has also acceptable reliability for all factors [Cronbach’s alpha ranging between 0.63 and 0.96 (McNair et al., 1971)].

To assess changes in mindfulness skills, the following scales were administered (pre-and post-intervention):

- Five Facet Mindfulness Questionnaire (FFMQ; Baer, Smith, Hopkins, Krietemeter, & Toney, 2006) is an instrument that consists of 39 items assessing five elements of mindfulness: observing, describing, acting with awareness, non-judging of inner experience and non-reactivity to inner experience, with an internal consistency ranging from 0.75 to 0.91 (Baer et al., 2006).
- Experiences Questionnaire (EQ, Fresco et al., 2007), designed to measure decentering ability (i.e. the capacity to observe one’s thoughts and feelings as temporary and objective events of the mind) and has a good reliability \[\alpha = 0.90\] (Fresco et al., 2007).

**Data analyses**

Data were analyzed using the PASW Statistics 18.0 software package for Windows. Patients were included in the analyses only if they had a baseline measure and all hypotheses were tested with a two-sided significance level of 0.05. Demographic and clinical variables were compared using the chi-square test for categorical variables and t-test for continuous variables. A repeated measures ANOVA was used (treatment as between-subjects factor) and time (pre-and post-intervention as within-subjects factor) to analyze CPT-II variables. Pearson correlations were performed to test the second hypothesis. In addition, a backward stepwise regression model was carried out, including significant clinical variables, to confirm their effect on the minutes of formal practice. Missing data were treated with two approaches: mean substitution approach and EM algorithm for each group and occasion in order to maintain the sample size of both groups. Analyses revealed almost identical findings with both approaches (with no increase of standard errors). Although EM algorithm is more rigorous to estimate parameters and depends on the unobserved latent variables, we present the results with mean substitution approach which approximates parameters using the observed adjacent values (although such a process adds no new information and may underestimate standard errors).

**Results**

**Patient demographics and baseline clinical characteristics**

There were no significant differences between participants (59) and non-participants (9) regarding severity, duration of illness or demographics (data not shown).

As shown in Table 1, there were no significant differences between the two groups in terms of demographic variables or clinical severity. All patients received pharmacological treatment, but we found no significant differences in medication type between the groups (Table 1). Drop-out rates were similar in the two groups (see Table 1). No statistical differences were found among subjects who discontinued and subjects who continued in the study (data not shown).
Table 1
Summary of demographic and clinical variables of the two groups.

<table>
<thead>
<tr>
<th></th>
<th>GPM (n = 19)</th>
<th>DBT-M (n = 40)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender (N/% females)</td>
<td>15/78.9%</td>
<td>36/90%</td>
</tr>
<tr>
<td>Age</td>
<td>31.78 (9.55)</td>
<td>29.33 (6.27)</td>
</tr>
<tr>
<td>Years of education</td>
<td>10.94 (2.82)</td>
<td>11.52 (2.34)</td>
</tr>
<tr>
<td>Marital status (N/%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Married/stable couple</td>
<td>8/42.1%</td>
<td>14/35%</td>
</tr>
<tr>
<td>Single</td>
<td>9/47.3%</td>
<td>19/47.5%</td>
</tr>
<tr>
<td>Separated/divorced</td>
<td>2/10.5%</td>
<td>7/17.5%</td>
</tr>
<tr>
<td>DBT-M</td>
<td>8.38 (1.06)</td>
<td>7.55 (1.22)</td>
</tr>
<tr>
<td>Other axis II disorders</td>
<td>0.88 (0.35)</td>
<td>1.1 (1.12)</td>
</tr>
<tr>
<td>Attendance to intervention (%)</td>
<td>72.37a</td>
<td>67.75a</td>
</tr>
<tr>
<td>Drop-out (%)</td>
<td>31.58</td>
<td>27.5</td>
</tr>
<tr>
<td>Pharmacological treatment (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Antidepressant</td>
<td>78.9</td>
<td>72.5</td>
</tr>
<tr>
<td>Benzodiazepine</td>
<td>57.9</td>
<td>52.5</td>
</tr>
<tr>
<td>Stabilizer</td>
<td>47.4</td>
<td>52.5</td>
</tr>
<tr>
<td>Antipsychotic</td>
<td>42.1</td>
<td>52.5</td>
</tr>
</tbody>
</table>

Note: Values represent mean scores (SD between brackets) or otherwise specified.

† DB-R – Diagnostic Interview for Borderlines-Revised.

* Number of maximal of sessions (GPM = 4; DBT-M + GPM = 10).

1st Hypothesis: attention differences between GPM group and DBT-M + GPM group

Table 2 presents a summary of the mean pre- and post-intervention measurements. On average, all patients had atypical scoring in most variables, displaying a clinical profile, as delivered by normative data of CPT-II manual (Conners, 2000). The repeated measures ANOVA showed a significant group \times time effect \((F(4,52) = 3.3, p = 0.02, \beta = 0.8)\). Univariate contrasts show significant group \times time effects for Commissions \((F(1, 57) = 4.3, p = 0.043)\), Hit reaction time \((F(1, 57) = 7, p = 0.011)\), Impulsivity \((F(1, 57) = 9.3, p = 0.003, see Fig. 2 as an illustration of ANOVA main effect on impulsivity variables) and Inattention \((F(1, 55) = 6.5, p = 0.014)\) variables. Significant group effects were observed in Commissions \((F(1, 57) = 7.7, p = 0.007)\), Hit reaction time \((F(1, 57) = 7.4, p = 0.009)\), Impulsivity \((F(1, 57) = 11.7, p = 0.001)\), and Detectability \((F(1, 57) = 6.4, p = 0.01, see Fig. 3 as an example of group effect on attention variables). Posthoc analyses showed that, after treatment, patients receiving GPM worsened significantly in Impulsivity \((p = 0.01)\) and Inattention \((p = 0.007)\), whereas the DBT-M + GPM group improved in measures of impulsivity: fewer commissions \((p = 0.009)\), slower responses \((p = 0.02)\), lower scores on impulsivity index \((p = 0.04)\).

2nd hypothesis: clinical outcomes related to formal practice in DBT-M + GPM patients

The group mean of formal mindfulness practice was 11.5 min \((SD = 10.15, range: 0–38)\). Correlation analyses were performed to determine the association between the averaged daily formal practice with pre-post changes in clinical variables measured by delta (Δ) calculation (post-intervention minus pre-intervention scores). In order to clarify the role of formal practice in these correlations, we first performed an analysis relating attentional variables at baseline and the averaged minutes of formal practice. There was no significant relation between these variables \((p > 0.05)\). In addition, we also analyzed whether mood \([HRSD-17 mean score 18(\pm 3.9); range: 12–24]\) and anxiety symptoms \([POMS mean score 13.8(\pm 2.7); range: 9–20] were related to CPT-II scores. None of the associations reached significance level, so an influence of mood symptoms was ruled out \((p > 0.2)\).

Average of maximal minutes of daily formal practice was significantly related with improvements in symptomatology: \(\Delta HRSD (r = 0.867, p < 0.001), \Delta BRPS (r = 0.867, p < 0.001), and by the following scales of the POMS \([\Delta Depression (r = 0.53, p = 0.01), \Delta Confusion (r = 0.73, p < 0.001), and \Delta Total Mood Distortion Scale (r = 0.46, p = 0.03)]\). In addition, the amount of formal practicing was significantly correlated with the delta Non-Reactivity to Inner Experience Scale from FFMQ \((r = 0.56, p = 0.008)\). Those significantly related deltas were included in a multiple regression linear model, taking averaged minutes of daily formal practice as the dependent variable. The regression model displayed a significant model \((F = 4.32, p = 0.04)\) which included \(\Delta HRSD, \Delta Depression and \Delta Confusion and \Delta Non-Reactivity to Inner Experience Scale from FFMQ. The model explained almost a 70% of variance \((R^2 = 0.68)\).

Discussion

DBT-M effects on attention

Patients who underwent a DBT-M + GPM showed a general improvement on CPT-II variables. In addition, improvement was
also observed in the composite scores from CPT-II, regarding Impulsivity and Inattention. Observed changes in “Detectability” and “Hit Rate” suggest that mindfulness training increased patient’s ability to discriminate between targets and non-targets, and longer times would be needed to respond correctly. DBT-M + GPM group made fewer commission errors, which indicates better accuracy in inhibiting responses to non-targets. In agreement with that, negative scores on Inattention index and positive effects on Impulsivity Index would reflect an improvement on impulsive behaviors rather than attentive deficits. As Sahdra et al. (2011) pointed out in a study analyzing effects of meditation practices on executive control, “when people perform response inhibition tasks for extended periods accuracy notably decreases over time”.

In this way, the fact that the GPM group had worse scores on Impulsivity index on the second occasion would be interpreted so as to having responded quicker and less accurate, which could be due to excessive confidence with the task on the second occasion, although there is no data on test-retest reliability of CPT-II (Conners, 2000). Interestingly, the DBT-M + GPM group did not show such an effect, or at least no worsening was observed in this group on any of the indexes. These results should be taken, however, with some caution, due to the absence of a randomization. Another explanation is that patients receiving GPM would feel less motivated to repeat CPT-II test than patients assigned to a more active intervention of treatment as it is DBT-M + GPM. In any case, the administration of a computerized task such as CPT-II provides a non-biased evaluation.

The relation between dispositional mindfulness and sustained attention in healthy subjects has been previously studied using the CPT-II and self-reported mindfulness questionnaires (Schmertz et al., 2008). The authors found that higher mindfulness scores measured by the MAAS and CAMS-R were related to better attention scores (measured with number Omission errors on the CPT-II). Another study (Cusens, Duggan, Thorne, & Burch, 2010) has investigated whether attention and awareness were modifiable with mindfulness. In this non-randomized controlled study of chronic-pain patients, who underwent breathworks mindfulness-based pain management programme, were compared to chronic-pain patients receiving treatment as usual. Although self-reported measures of mindful-attention improved, no changes in CPT indexes were observed. These studies mentioned above were carried out with non-psychiatric populations and, as Anderson, Lau, Segal, and Bishop (2007) have already suggested in their study assessing the effects of Mindfulness-Based Stress Reduction on attention, it is possible that psychiatric populations may show improvements in attention that were no evident in other populations. The fact that these studies did not find a clear relation with attention could be due to lower amount of formal practice. Indeed, most of controlled mindfulness studies that found an association between mindfulness and attention included experienced participants and after longer retreat periods of practicing (Jha et al., 2007; Lutz et al., 2009; MacLean et al., 2010; Slagter et al., 2007). Other studies, like the present one, that use less intense daily practice on naïve populations could therefore deliver contradictory results, with some reporting positive findings (Jha et al., 2007) and others, not finding any relation (Anderson et al., 2007; Cusens et al., 2010).

Given the relevance of impulsivity in BPD patients, the present findings shed light on the approachability of this BPD core symptom. In this regard, impulsivity has been measured with other tools, and each of them would assess different aspects of impulsivity (Dougherty, Mathias, Marsh, & Jager, 2005). It is worth mentioning, however, that CPT-II is a neuropsychological test that measures sustained attention. This would probably be a limitation of this study, but CPT-II has previously been considered as a Go/No go task, and indeed, it delivers a measure of a subtype of impulsivity (Conners, 2000). It has been recently reported that an enhancement of executive control, defined as the ability to inhibit undesired responses, was increased after a mindfulness retreat, and additionally, this increased response inhibition predicted adaptive functioning post-retreat and after 5 months of follow-up (Sahdra et al., 2011). Impulsivity improvement is also confirmed by longer reaction times in spotting hits after DBT-M + GPM, a finding that is in congruence with Van den Hurk, Giommi, Gielan, Specckens, and Barendregt (2010) but not with Lutz et al. (2009) studies with healthy subjects undergoing mindfulness training. Non-psychiatric controls differ in many aspects to patients with BPD, as borderline individuals are prone to show elevated basal scores on variables as impulsivity (Leichsenring et al., 2011) and the effects of training in mindfulness might be different depending on the sample. Likewise, as Van den Hurk proposes, the slightly incremented latencies of response could be a result of changes in the relation between speed and precision. Thus, mindfulness practitioners “…would have put more emphasis on accuracy, accepting longer reaction times” (Van den Hurk et al., 2010).

**Mindfulness formal practice outcomes**

Our findings show that longer formal practice periods correlated with prominent reduction in depressive and confusion symptoms. In addition, reactivity to inner experiences was also decreased with longer practices. By contrast, none of the cognitive variables were associated with time of formal practice. Regular daily practice of mindfulness meditation is one of the essential aspects that should lead to therapeutic benefits of mindfulness-based programmes (Kabat-Zinn, 1990; Kabat-Zinn et al., 1998). However, a recent review of twenty four studies that evaluated the associations between home practice and measures of clinical functioning reported conflicting results (Vettese, Toneatto, Stea, Nguyen, & Wang, 2009). Our results seem to indicate that mindfulness intervention would have a primarily effect on mood/emotion variables, as many studies have already established (see Baer, 2003, for review). In this sense, impulsivity improvement may be understood as a secondary mood-dependent phenomenon. This would be congruent with Linehan’s (1993a) biosocial model, where the extreme problematic impulsive behaviors displayed by patients with BPD (e.g., suicide, self-mutilation, substance abuse…) are the common aftermaths of strong negative moods (Linehan, 1993a). Recent evidence suggests a common and unique system for both impulsiveness and emotion, which transacts and contributes to different aspects of BPD.
symptoms (Crowell, Beauclaire, & Linehan, 2009). Further studies should assess this relationship between impulsivity and emotional instability. Improvements in impulsivity and attention may be due to factors (such as attending group therapy, per se) unrelated to the amount of formal practice time. It is known that structured interventions are as useful as specific-designed therapies for BPD, as several studies have shown (Leichsenring et al., 2011; for a review). The lack of a comparison group (i.e. non-mindfulness focused: psychoeducation, social skills training) is a limitation and does not allow us to ascertain whether it is a mindfulness or a group therapy effect.

Conclusion
This is probably the first study so far that addresses the feasible attentional mechanisms underlying core mindfulness skills, which is the single most practised module of DBT by BPD patients (Lindenboim et al., 2007; Stepp et al., 2008). It also attempts to assess the effects of a single DBT module (“Core Mindfulness Skills”). The findings show that DBT-M + GPM seems to improve attention and, interestingly, impulsivity variables. Moreover, it has similar drop-out rates as other skills training group therapies (Blum et al., 2008; Soler et al., 2005; 2009). When analyzing only those patients receiving mindfulness training, formal practice is mainly related to mood amelioration in BPD patients but not to CPT-II performance, which would be explained by a direct effect of exercising mindfulness on emotional variables and a secondary effect on impulsivity.

Declaration of interest
None.

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