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Effects of Dialectical Behavior Therapy on Executive Functions, Emotion Regulation, and Mindfulness in Bipolar Disorder

Behrooz Afshari[1] · Abdollah Omidi[1] · Afshin Ahmadvand[2]

Abstract

Bipolar disorder (BD) is a debilitating psychiatric disorder characterized by recurrent depression, manic, and hypomanic episodes. Patients with BD are also likely to experience difficulties with executive functions and emotion regulation. The literature review states that little research has been done on dialectical behavior therapy (DBT) for BD, and there has not been an examination of this therapy on BD patients' executive functions and emotion regulation. The present study addresses this absence of research with a pilot study on 60 BD patients. Participants in the intervention group received twelve 90-min sessions adapted from a standard DBT protocol for BD and the control group was on a wait-list for treatment. Participants completed measures of mental wellbeing and executive functioning at baseline, immediately after the intervention, and 3 months later as a follow-up. Results showed that the intervention group improved over time, having lower scores in mania, depression, and emotion disregulation than the control group post-treatment. Further, the intervention group had higher scores in mindfulness, planning, problem-solving, and cognitive flexibility than the control group. The findings highlight that DBT, alongside prescription medication, can be an effective therapy for BD as well as leading to reduced manic and depression symptoms and improved executive functions, emotion regulation, and mindfulness.

Keywords Bipolar disorder (BD) · Dialectical behavior therapy (DBT) · Executive functions · Emotion regulation · Mindfulness

Introduction

Bipolar disorder (BD) is characterized by depressive, manic and hypomanic episodes. The disorder is further differentiated into Bipolar I disorder, requiring at least one manic episode or sometimes major depressive episodes, and Bipolar II disorder defined by at least one major depressive and multiple hypomanic episodes (Kaplan 2016).

Difficulties with executive functions and emotional regulation in those diagnosed with BD have been well documented e.g. (Hafeman et al. 2014). What are less documented are improvements in these executive and emotional skills as a result of BD-focused therapy.

Executive functions' is a summary term for a variety of complex cognitive skills, such as an individual's organization, self-regulation, perception, thoughts, emotions, cognitive flexibility, planning, and problem-solving. Executive functions is related to many day to day behaviors, such as job performance, communication with family members, and life satisfaction (Cotrena et al. 2016). Importantly, executive deficits have been shown to have comprehensive and significant implications in 'real life', often demonstrated as severe problems in the regulation of behavior (Dickinson et al. 2017). Various executive impairments have been associated with BD in the literature (Abé et al. 2018), suggesting that addressing these co-morbid impairments could help improve the wellbeing of patients.

The aforementioned executive functions impairments have been related to functioning deficiencies in the frontal lobe (Shafritz et al. 2018). The frontal lobe has also been proposed as a major neural substrate of emotion regulation

✉ Behrooz Afshari
  Behrooz.afshari71@gmail.com

  Abdollah Omidi
  abomidi2020@gmail.com

  Afshin Ahmadvand
  ghoreishi125@gmail.com

[1] Department of Clinical Psychology, Kashan University of Medical Science, Kashan, Iran

[2] Department of Psychiatry, Kashan University of Medical Science, Kashan, Iran

(Goitia et al. 2017). Deficits in the emotion regulation are central to the clinical diagnosis of BD (Hafeman et al. 2014) and is summarized as emotional hyper-responsiveness, poor recognition and acceptance of emotions, and difficulties in adapting behaviors to experienced emotions (Richard-Lepouriel et al. 2016). Emotion regulation is associated with cortical control over limbic regions (Picó-Pérez et al. 2018). More automatic processes involve predominantly medial prefrontal cortical (PFC) structures, including the anterior cingulate cortex (ACC), orbitofrontal cortex, and PFC, as well as the hippocampus (Rive et al. 2015).

Nowadays, therapists provide specified treatments for both manic and depressive episodes of BD. The principal treatment for BD is medication, and less research has been done in the field of psychotherapy (Van Dijk et al. 2013). Research suggests that medication alone is not an effective treatment for BD, but outcomes can be improved with the addition of psychotherapeutic treatment (Swartz et al. 2009). Cognitive behavior therapy (CBT) led to significant improvements in treating dysfunctional cognitions and behaviors in those suffering from depressive and anxiety disorders (da Costa et al. 2010). However, it is a challenge for those patients with BD symptoms to undergo therapy during a mania episode (Lotufo Neto 2004).

Dialectical behavior therapy (DBT) was initially used for treating the symptoms of Borderline Personality Disorder, suicide, and self-harm attempts (Linehan 1993). In DBT, like other behavioral approaches, it is assumed that all behaviors are learned (Pederson 2015). The initial focus in DBT is to educate the patients to regulate their emotional responses to events (Gross 2013). Techniques in DBT have not been applied for executive functions in BD, but evidence suggests that these techniques may be beneficial for BD (McMahon et al. 2016). In recent years, the use of DBT has been extended to other types of mental disorders (Van Dijk 2013), including substance-related and addictive disorders, eating disorders, schizophrenia, and post-traumatic stress disorder. With this growing utility of DBT, it is important to evaluate how this style of therapy may benefit those diagnosed with BD. However, little research has been done on BD to date (Harvey and Rathbone 2014).

The Present Study

Specifically, no research has been conducted to study the effect of DBT on executive functions in those with a BD diagnosis. Studies have demonstrated that DBT is the most effective treatment for Borderline Personality Disorder (Bohus et al. 2000; Linehan et al. 1991, 1993). Given the similarities between Borderline Personality Disorder and BD (e.g., emotion disregulation, interpersonal difficulties, suicide, and impulsivity), it is reasonable to hypothesize that

DBT could also be an effective treatment for BD. Therefore, the purpose of the present study was to examine the effects of DBT skills based psycho-education on executive functions, emotion regulation, and mindfulness in BD.

Materials and Methods

Participants

Sixty patients with BD, who had been referred to Kargar-nejad Hospital (located in city of Kashan, Iran) between October 2016 and November 2017, were included in the present study. This study was a pilot study in which the control group was a wait-list condition. Each group included 30 patients with BD. Those who were assigned to the intervention completed 12 sessions (one session per week).

All patients who were eligible to participate in the present study were randomly assigned to either condition; the intervention (medications + DBT) or a wait-list control (medications only). In this way, all patients had the opportunity to participate in the intervention group. All patients with BD were previously diagnosed by a trained psychiatrist through a structured clinical interview for DSM-IV Axis I disorders (First et al. 1995). This interview was used for diagnosis of BD and any comorbid conditions. Inclusion criteria for this study were the presence of BD, an educational level higher than the eighth grade (to perform the questionnaires and tasks correctly), an age between 18 and 45 years and no previous psychotherapy for at least 6 months prior to the study. Exclusion criteria included any individual experiencing current manic and psychotic episodes, and any individual with two or more absentee sessions from the 12 week intervention programme. All patients were taking medication at the baseline, prescribed by specialist psychiatrist. The most commonly used medication included lithium, SSRIs, Clozapine, and Carbamazepine. 30 % were diagnosed with bipolar I and 70% with bipolar II disorder. Measures were administered at pre-test, post-test, and follow-up. After completing informed consent and SCID-I evaluations, the patients responded to the critical questionnaires and executive functions tasks (see below). The executive functions tasks were presented and completed on a computer (PEBL software) (Fig. 1).

The Intervention

The DBT intervention for BD is based on the manual of Sheri Van Dijk (Van Dijk et al. 2013). Participants in the intervention group received twelve 90-min sessions of adapted DBT for BD. Two sessions of this intervention focused on providing education about BD including symptoms, types, and causes of BD. One session was a presentation by a psychiatrist on medications used to treat BD. Another session focused on the
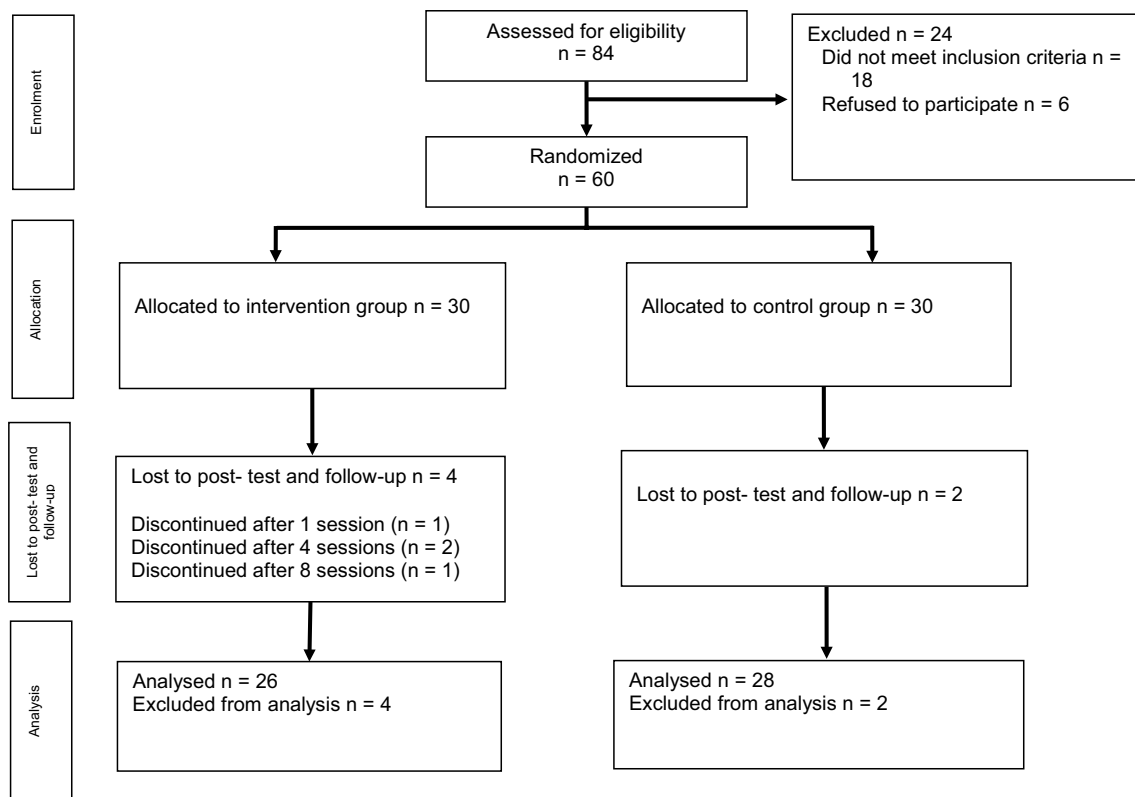
Fig. 1 Participant flowchart

importance of self-care (balancing sleep, eating, exercise, and building mastery). The other eight sessions focused on distress tolerance skills (radical acceptance, self soothe, and pro and con list) to help patients improve their self-control and manage crisis situations. There was a focus on emotion regulation skills (understanding our emotions, opposite actions), including general information about emotions and techniques to help patients reduce the amount of emotional pain they can experience. Further, these sessions included information on how to tolerate painful emotions when they cannot be changed and interpersonal effectiveness skills (listening, sensitivity, and respect) to help patients develop healthier relationships. The therapist was an experienced clinical psychologist who was trained DBT in Kashan University of medical sciences. He attended workshops and certified in DBT. Bipolar patients were incorporated with counselor. Also, there was a co-therapist for following homework and continuation of sessions. Each group included eight patients, and the groups were open.

Measures

Demographics

Demographic information of the participants, such as bipolar type, age, gender, marital status, years of education,

diagnostic age, number of hospitalization, age at first hospitalization, comorbidity with other disorders, and psychotherapy history was collected using the Demographic Questionnaire.

Structured Clinical Interview for DSM-IV Axis I Disorders (SCID-I)

The SCID-I is one of the most widely used structured interviews for the presence of Axis I Disorders, including schizophrenia and bipolar disorder (Afshari et al. 2019). The SCID-I has a screening form consisting of 24 items evaluating symptomology for various Axis I disorders (First et al. 1995). The SCID-I has demonstrated appropriate psychometric characteristics in the Iranian (Persian) community. Diagnostic agreements between test and retest SCID-I administration were fair to good for most diagnostic categories. Overall weighted kappa was 0.52 for current diagnoses and 0.55 for lifetime diagnoses. In an Iranian healthy sample, the internal consistency of SCID-I using Cronbach's alpha ranged from 0.66 to 0.79 (Rezaei et al. 2011). Specificity values for most psychiatric disorders were high (> 0.85); the sensitivity values were somewhat lower (Sharifi et al. 2009).

Young Mania Rating Scale (YMRS)

This 11-item scale has 7 items scored from 0 to 4 and 4 items from 0 to 8, completed after a clinical interview with the patient. The YMRS (Yang et al. 2015) is a tool with validity, sensitivity, specificity, and is suitable for clinical and research work. The YMRS showed reliability index of 0.88 (internal consistency) and 0.76 (test–retest reliability) when compared to the mania subscale of the Modified Clinical Global Impression (Colom et al. 2002; Karadağ et al. 2002). YMRS had a high internal consistency (Cronbach's alpha = 0.82) in Iranian population and it also showed a high concurrent validity with mixed subscale of BDRS (r = 0.74.5) (Ebrahimi et al. 2017).

Beck Depression Inventory (BDI-II)

The BDI-II is a 21-item self-report questionnaire designed to assess for depression. The scores range from 0 to 63, with a score of 10–19 considered as mild depression, a score of 20–28 denoting medium depression and a score of 29–63 as severe depression (Beck et al. 1996). In an Iranian healthy sample, the internal consistency of BDI-II using Cronbach's alpha ranged from 0.58 to 0.79 for all factors (Richter et al. 1998). Internal stability of test the Iranian students was estimated 0.87 and its reliability was 0.73 (Meygoni and Ahadi 2012).

Difficulties in Emotion Regulation Scale (DERS)

The DERS is a 36-question self-report scale for assessing of emotion disregulation. Participants answer on a 5-point Likert-type scale ranging from 1 (almost never) to 5 (almost always), and higher scores indicate a higher level of emotion disregulation (Gratz and Roemer 2004). This scale demonstrated adequate construct and predictive validity and good test–retest reliability. In an Iranian healthy sample, the internal consistency of DERS using Cronbach's alpha ranged from 0.66 to 0.88 for all factors (Bjureberg et al. 2016). Also, studies have suggested sufficient construct and predictive validity to the scale. Internal stability of test Iranian population was estimated 0.82 and its reliability was 0.68 (Khanzadeh et al. 2012).

Five Facet Mindfulness Questionnaire (FFMQ)

The FFMQ is a 39-item self-report questionnaire for evaluate of mindfulness. Participants answer on a 5-point Likert-type scale ranging from 1 (never or very rarely true) to 5 (very often or always true), with higher scores indicating higher levels of

mindfulness. The Dutch FFMQ has shown adequate construct validity and test–retest reliability (Bohlmeijer et al. 2011). In an Iranian healthy sample, the internal consistency of FFMQ using Cronbach's alpha ranged from 0.55 to 0.83 for all factors (Heydarinasab 2013).

Tower of London Task (TOL)

The TOL is an executive functions task originally developed by Tim Shallice, with the purpose of planning and goal-directed behaviors. This task consists of three balls of differing colors. Two sets of three colored balls present, one in the upper half of the screen and one in the lower half. On each trial, the red, blue and green balls of both sets are shown in predetermine but different positions. The TOL is mainly used as a planning tool in a variety of domains. The TOL has been widely used in clinical individuals in order to assess the planning abilities and frontal lobe functions (Afshari et al. 2019; Kaller et al. 2004). In an Iranian healthy sample, the internal consistency of TOL using Cronbach's alpha was 0.72 to 0.78 (Asgari Nekah and Abedi 2014).This task was presented and completed on a computer (PEBL software).

Wisconsin Card Sorting Task (WCST)

The WCST incorporates four types of stimulus cards that vary by number, shapes, and color. This task evaluates problem-solving and is a measure of an individual's executive functions skills (Baldo et al. 2005). In this computer task, subjects classified into 128 cards using four templates. The WCST main indicators are the number of correct responses, total errors, number of continues reaction, perseverative errors, non-perseverative errors, and the number of completed categories (Yang et al. 2015). In an Iranian healthy sample, the internal consistency of WCST using Cronbach's alpha was 0.73 to 0.74 (Shahgholian et al. 2012). This executive functions task requires participants to sort cards according to a rule that is not made clear to them, and so they must discover the rule using trial and error. This task was presented and completed on a computer (PEBL software).

Data Analysis

SPSS 21.0 was used to run statistical analyses. There were missing data in the current study as six patients excluded from the study. The nominal variables of the groups were compared using the Chi square test. Analysis of repeated measure was performed by comparing the groups. In order to compare means of the age, education, YMRS, and BDI-II, analysis of variance (ANOVA) were used.

Results

Demographic and clinical characteristics of participants are presented in Table 1. The intervention group included 16 women (53.2%) with an age range of 18–44 years (M = 36.00, SD = 6.00). The control group included 18 women (60%) with an age range of 19–45 years (M = 37.00, SD = 6.00). Twenty-six of the intervention group completed the study, and 28 of the control group completed the study. There were no differences in demographic and clinical characteristics of participants between the intervention and control groups. Missing data (four from the intervention group, two from the control group) presented in the supplemental materials of this paper and explained in the discussion. Also, there were no differences between patients who completed therapy and patients who dropped out from treatment.

The distribution of scores for the measures at baseline, post-treatment and 3-month follow up, with tests for differences between groups, are presented in Table 2. In general, YMRS and DBI-II scores reduced over time for DBT group indicating reduced manic and depression symptoms 3 months after intervention and at 3 months follow-up. During this time the control group did not change (see Table 2 for all results).

There was also improvement across the executive functions measures for the intervention group. TOL scores demonstrated improved planning after intervention and at follow-up, but the control group did not change. All WCST subscales, including average correct, error, perseverative, and non-perseverative scores, improved over time for the intervention group indicating improved problem-solving and cognitive flexibility, while in control group all subscales were stable. The average DERS scores improved over time for the DBT group indicating lasting improvement in emotion regulation for those in the intervention condition.

Also, MANOVA showed that residual scores produced by all subscales of the DERS (including non-acceptance, goals, impulse, awareness, strategies, and clarity) improved over time for the DBT group. The control group did not very over the post-test and 3 months follow-up.

Mindfulness (measured by the FFMQ scores) improved over time for DBT group indicating improved mindfulness after 3 months of intervention and 3 months follow-up (Table 2). Also, further analysis showed that differences between groups in subscales of FFMQ, including awareness and non-reactive items, were significantly different. However the observe, describe, and non-judge items were not significant. In the control group, all subscales did not vary over time.

Discussion

Results from this study suggest that DBT may be an effective treatment for some of the symptoms of bipolar disorder. However, few studies have been conducted on this subject. This is the first study of DBT on executive functions in BD. We aimed to study DBT on planning, problem-solving, psychological flexibility, emotion regulation, mindfulness, manic, hypomanic, and depression symptoms in BD. Our findings demonstrated that all of these features improved over the time of the study for those in the intervention group. The results highlight that creating an effective therapeutic relationship with specific and regular exercises and following these exercises lead to symptoms reduction and improvement of abilities in executive functions and emotion regulation in bipolar patients.

It can be the case that attrition from psychotherapy research suggests that the proposed treatment does not work for those experiencing the strongest symptoms. However this was not the case here, as the participants who did not complete the study were patients who were in a stable condition and not unique in their symptoms. The severity of

Table 1 Demographic features of the sample

	Intervention (n = 30)	Control (n = 30)	P value
Bipolar diagnosis (type I/type II)	n = 8/22	n = 10/20	0/793
Mean age (SD)	36.00 (6.00)	37.00 (6.00)	0/877
Number of female patients	53% (n = 16)	60% (n = 18)	0/602
Marital status (single/married/divorced or separated)	n = 13/17/4	n = 12/18/2	0/930
Mean years of education (SD)	11.00 (2.02)	10.00 (2.00)	0/990
Mean age at diagnosis (SD)	23.00 (7.00)	22.00 (7.00)	0/733
Mean number of previous hospitalizations (SD)	3.00 (2.00)	3.00 (3.02)	0/785
Mean age at first hospitalization (SD)	18.00 (12.00)	17.00 (13.01)	0/558
Number with comorbid diagnoses (%)	33.3% (n = 10)	36.6% (n = 11)	0/788
Number with previous engagement with psychotherapy (%)	53.2% (n = 16)	60% (n = 18)	0/602

Table 2 Descriptive statistics for the measures over the three time periods assessed in this study by condition

Measure	Intervention Group (n=26) Mean (SD)			Control Group (n=28) Mean (SD)			Main effect of Time	Main effect of Condition	Condition*Time Interaction
	Pre-Treatment	Post-Treatment	Follow-up	Pre-Treatment	Post-Treatment	Follow-up			
YMRS	15.65 (7.19)	10.88 (3.50)	10.57 (3.73)	14.39 (7.47)	13.57 (6.96)	14.39 (7.47)	$F=18.08$, $p<.001$	$F=1.80$, $p=.184$	$F=13.36$, $p<.001$
BDI-II	9.65 (5.82)	6.42 (3.41)	6.96 (4.34)	10.46 (5.97)	10.14 (5.81)	10.46 (5.97)	$F=28.76$, $p<.001$	$F=6.84$, $p=.011$	$F=20.75$, $p<.001$
DERS	129.80 (30.57)	120.07 (17.30)	120.92 (24.4)	136.50 (25.74)	135.10 (25.14)	136.39 (25.73)	$F=32.06$, $p<.001$	$F=22.12$, $p<.001$	$F=24.14$, $p<.001$
FFMQ	96.76 (9.15)	102.56 (8.37)	95.72 (5.31)	93.51 (5.70)	93.77 (6.21)	93.74 (7.83)	$F=34.18$, $p<.001$	$F=27.26$, $p<.001$	$F=25.32$, $p<.001$
TOL	11.00 (3.38)	16.19 (5.28)	14.23 (3.40)	10.92 (3.89)	11.03 (3.85)	10.60 (3.28)	$F=17.66$, $p<.001$	$F=20.51$, $p<.001$	$F=14.11$, $p<.001$
WCST									
Trials Correct[a]	48.57 (10.32)	63.30 (16.24)	56.84 (15.75)	47.82 (11.46)	42.34 (10.84)	43.82 (10.55)	$F=12.38$, $p<.001$	$F=20.48$, $p<.001$	$F=14.83$, $p<.001$
Trials Error[a]	79.42 (10.46)	64.69 (16.24)	71.15 (15.75)	80.17 (11.55)	86.65 (10.19)	84.17 (10.63)	$F=12.38$, $p<.001$	$F=20.48$, $p<.001$	$F=14.83$, $p<.001$
Perseverative	38.88 (14.43)	27.92 (14.89)	33.61 (15.46)	39.85 (15.36)	42.85 (14.17)	43.85 (15.12)	$F=7.78$ $p=.002$	$F=9.05$, $p=.004$	$F=8.36$, $p=.032$
Non-perseverative	40.53 (10.06)	35.69 (10.67)	37.53 (10.25)	40.32 (11.85)	43.75 (11.65)	40.92 (12.45)	$F=4.80$ $p=.004$	$F=0.32$, $p=.575$	$F=2.34$, $p=.002$

YMRS Young Mania Rating Scale, *BDI-II* Beck Depression Inventory–II, *DERS* Difficulties in Emotion Regulation Scale, *FFMQ* Five Facet Mindfulness Questionnaire, *TOL* Tower Of London computerized task, *WCST* Wisconsin Card Sorting Task

[a]Differences for WCST trials correct and error are the same due to the interdependence of the variables

their depression and mania were similar to those who stayed in the study. There are two possibilities for why they did not continue to the study; negative attitude towards psychotherapy in general, and previous, unsuccessful engagement with psychotherapy.

Two previous pilot studies have investigated the use of DBT for BD. In the first study, (Van Dijk et al. 2013) studied a sample of 13 patients with BD who completed twelve sessions of group DBT. This study showed a trend toward reduced depressive symptoms, significant improvement in mindful awareness and control of emotional states. In the second study (Goldstein et al. 2015), 14 adolecents diagnosed with BD received 36 DBT sessions. Adolecents receaving DBT demonstrated less severe depression symptoms and decreased suicidal idiation. Our current work expands on these findings. We also find a decrease in BD symptoms for our intervention group, but also found improvement in emotion regulation and executive functions. Emotion regulation seems to be a gateway to improvement in other functions and symptoms of BD. When bipolar patients better regulate their emotions, the symptoms of BD reduce. DBT through emotion regulation leads to improved attention, concentration and awareness. Once attention, concentration and awareness are improved, executive functions such as planning and problem-solving are also improved. In fact, emotion regulation is considered as a mediator variable.

As almost all of the techniques of DBT are targeted at emotion regulation features (Eisner et al. 2017; Goodman et al. 2014; Van Dijk et al. 2013), it seems reasonable that DBT can affect emotion regulation in BD. The ability of an individual to regulate emotions throughout life varies and improves as one gets older. It is possible to deliver therapeutic intervention with problematic emotion regulation with adults who did not acquire the emotion regulation skills as a child. In sum, emotion regulation strategies are a basic principle in initiating, evaluating, maintaining and organizing adaptive behavior, as well as preventing negative emotions and uncompromising behaviors.

The results of this study showed an improvement of in mindfulness skills for the participants in the DBT intervention condition. Mindfulness techniques in DBT teach patients to develop more awareness of their emotions, thoughts and behaviors, and thus, increase the level of self-control and the ability to manage emotions. Applying

mindfulness exercises to bipolar patients can help them adopt more effective strategies for regulating emotions. When emotions appear in the form of thoughts at the same time as physical sensations, if one learns to stay in this state with his physical sensations, one's emotional responsiveness could be reduced. Mindfulness helps people to self-control and self-esteem by mastering the inner experiences (thoughts, emotions, mental images and body feelings) before being subjected to stress-inducing stimuli.

Limitations

This study has some limitations. A clear challenge was keeping patients engaged with the sessions and their homework. Another limitation was that all patients were under medication and it is possible (although unlikely, given our randomised control trial approach) that idiosyncratic responses to the medication may have created our effects. We suggest future research should try to obtain BD patients samples not on medication. There are risks to this approach too though, as those un-medicated patients are likely to be experiencing less severe symptoms. We note that this study was conducted in Iran and, whilst further research outside of the typical western psychiatric settings is needed, generalization of our results to other cultures should be done with caution.

Conclusion

Results of the present study are of significant importance for future studies. First of all, future works on the examination of other psychotherapies combination with medication for BD are needed. Secondly, DBT skills (in combination with medication) could also help other disorders characterised by executive dysfunction and emotion disregulation.

Compliance with Ethical Standards

Conflict of interest The authors declare that they have no conflict of interest.

Ethical Approval All procedures performed in this study involving human participants were in accordance with the ethical standards of the Local Ethics Committee at the Kashan University of Medical Sciences, Kashan, Iran (IRCT2017031233023N1).

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