Social cognition and interaction training (SCIT) for partially remitted patients with bipolar disorder in China

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ABSTRACT

Bipolar disorder (BD) is associated with functional impairment. Social Cognition and Interaction Training (SCIT) has been shown to be feasible and effective at improving social functioning in patients with schizophrenia. We aimed to explore the association between SCIT and improvements in the clinical symptoms and functioning of partially remitted patients with BD in China. Seventy-four BD patients were randomly assigned to the SCIT and psychoeducation (Control) groups. All subjects participated in group interventions weekly for 8 weeks. Furthermore, the participants were administered the Young Mania Rating Scale (YMRS), the 17-item Hamilton Depression Rating Scale (HDRS-17), the Function Assessment Short Test (FAST) and neurocognitive measures at baseline and after eight weeks. There were no differences in demographics, the HDRS-17, YRMS, and FAST scores or neurocognitive measures between the groups at baseline ($p > 0.05$). The repeated-measures analysis revealed that SCIT resulted in greater improvement in the HDRS, YMRS, and FAST scores (including six domains) ($p < 0.01$) and two neurocognitive measures ($p < 0.05$) compared to psychoeducation. Our findings suggest that SCIT is a feasible and promising intervention for the clinical symptoms and functioning of partially remitted patients with BD. Further longitudinal studies are needed to observe the long-term impact of SCIT on emotional and functional improvement in these patients.

1. Introduction

Bipolar disorder (BD) is a recurrent chronic disorder characterized by a fluctuating mood state. BD effects more than 1% of the population worldwide (Grande et al., 2016). Approximately 60%−70% of BD patients show poor social and occupational functioning, which have been linked to residual depressive or manic symptoms (Henry et al., 2015; Huxley and Baldessarini, 2010). Some studies have found that partially remitted BD patients still have moderate difficulty in social adjustment, poorer work ability and moderate-to-severe deficits in attention, processing speed, verbal learning and executive cognition (Jensen et al., 2016; Szmulewicz et al., 2018). Social cognition has been reported to be associated with psychosocial functioning in individuals with schizophrenia as well as those with BD (Lahera et al., 2015), and social cognition is considered a mediator between neurocognition and functioning (Koelkebeck et al., 2018). Ospina et al.'s findings also imply that social cognition may modulate the relationship between neurocognition and social functioning in BD (Ospina et al., 2018). Previous

studies have revealed that a social cognitive deficit is consistently present in BD patients (Ioannidi et al., 2015; Kerr et al., 2003). However, few studies have examined the relationship between social cognition and functioning in BD patients. As a core area in social cognition, emotional symptoms should be regarded as a target for psychosocial interventions for patients with BD as well as those with schizophrenia (Aparicio et al., 2016; Kessing and Miskowiak, 2018).

Social Cognition and Interaction Training (SCIT) was originally developed to improve social cognition and social functioning in individuals with schizophrenia (Penn et al., 2005). SCIT has been shown to be feasible and effective in improving social cognition in patients with schizophrenia spectrum disorders (Penn et al., 2005; Combs et al., 2007). A meta-analysis confirmed this effect of social cognitive training on social cognitive and functional outcomes in individuals with schizophrenia (Matthew et al., 2012). Furthermore, SCIT can not only change negative emotion perception and recognition in schizophrenia (Bartholomeusz et al., 2013) but also relieve depressive symptoms in patients with bipolar disorder or schizoaffective disorder (Lahera et al.,

2013). Zhu et al. demonstrated this efficacy of SCIT in patients with major depression (Zhu et al., 2018). Hasson-Ohayon et al.'s findings showed that SCIT could boost communication and interpersonal skills in patients with schizophrenia, but this efficacy needs to be clarified using more critical designs (Hasson-Ohayon et al., 2009).

To date, psychotherapeutic interventions have been developed for patients with BD. Some controlled studies and a systematic review elaborated on most psychosocial treatments and effects in BD, and the findings showed that only cognitive behavioral therapy (CBT) could improve the acute phase of bipolar depression, but CBT, interpersonal and social rhythm therapy, family therapy and psychoeducation could not improve the functional outcomes in BD (Demissie et al., 2018; Miziou et al., 2015; Reinares et al., 2014; de Barros Pellegrinelli et al., 2013). In addition, psychoeducation is regarded as an active comparator when psychotherapeutic intervention is adopted (Lahera et al., 2014). Recently, as a novel group intervention, functional rehabilitation or remediation (FR) has shown efficacy in BD patients. Some randomized controlled studies have revealed that FR could significantly improve functional outcomes compared to psychoeducation and treatment as usual (Solé et al., 2015; Torrent et al., 2013). Thus, we propose that SCIT could change the impaired functioning and emotional symptoms in partially remitted patients with BD. To date, the association between SCIT and improvement in social and neurocognitive function in bipolar patients is unclear. This study aimed to explore the effect of SCIT on the clinical symptoms and social and neurocognitive functioning of Chinese patients with BD in the context of a controlled trial.

2. Materials and methods

2.1. Subjects

This study was conducted at the outpatient clinic of Tianjin Anding Hospital between June 2015 and December 2016. Eighty partially remitted patients with BD aged 18–60 years who met the diagnosis of bipolar disorder according to the Diagnostic and Statistical Manual of Mental Disorders-fourth edition (DSM-IV) (Edition and Association, 1994) were consecutively recruited. Patients who had major physical diseases or a history of alcohol or substance abuse were excluded. We also excluded patients who received any structured psychological intervention, such as cognitive behavioral therapy (CBT) or psychoeducation within the past year. The enrolled bipolar patients were allowed to receive some atypical antipsychotic and mood stabilizer medication. The study protocol was approved by the Ethics Committee of Tianjin Anding Hospital. Written informed consent was obtained from all participants.

2.2. Assessment and materials

The basic sociodemographic characteristics of the participants, including age, sex, education level, occupation, duration of BD, family history and medications, were collected via an interview. The severity of the depressive and manic/hypomanic symptoms was measured using the 17-item Hamilton Depression Rating Scale (HDRS-17) and the Young Mania Rating Scale (YMRS), respectively. BP remission is defined as a Young Mania Rating Scale score ≤ 6 and a Hamilton Depression Rating Scale score ≤ 8 for two to three months (Samalin et al., 2016; Martino et al., al.,2011). Jensen et al.'s finding (Jensen et al., 2016) indicates that BD partial or full remission is defined as Hamilton Depression Rating Scale scores ≤ 7 or $8 \leq 14$ and Young Mania Rating Scale scores ≤ 7 or $8 \leq 14$, respectively, but no duration criteria are required. Our study defined partial remission as meeting the symptomatic remission criteria for at least one month.

Functional impairment was measured using the Chinese version of the Functioning Assessment Short Test (FAST). The FAST comprises 24 items, including the following six domains of functioning: autonomy,

occupational functioning, cognitive functioning, financial issues, interpersonal relationship and leisure time (Rosa et al., 2007). The FAST is rated on a 4-point scale (0–3) ranging from no difficulty to severe difficulty. The higher the total score is, the more severe the functional impairment. The Chinese version of the FAST has satisfactory psychometric properties in terms of validity and reliability in adults with BD. According to our earlier study, the cut-off value of the FAST to differentiate between the euthymic phase and the acute phases is 29, and the cut-off value to differentiate between healthy controls and the euthymic phase is 12 (Zhang et al., 2018). In this study, we chose participants with overall FAST scores between 12 and 29.

Neurocognition was measured using the Trail Making Test-A (TMT-A), Symbol Digit Modalities Test (SDMT), Hopkins Verbal Learning Tests-Revised (HVLT-R), Brief Visuospatial Memory Test-Revised (BVMT-R) and Stroop Color-Word Test (SCWT) to evaluate the speed of processing, verbal learning and visual learning memory, and executive function (Nuechterlein et al., 2008; Scarpina and Tagini, 2017). According to previous studies, in BD patients, the median TMT-A score is 24 (SD 5.0) (Mak et al., 2018), the mean level of the HVLT-R is 28 (SD 4.3) (Sumiyoshi et al., 2017), and the mean level of the BVMT-R and SDMT is 24 (SD 5.5) and 59 (SD 10) (Sousa et al., 2018), respectively. In the Stroop Color-Word Test (SCWT), the mean level in euthymic BD patients is 59 (SD 31.0) (Osman et al., 2007). All ratings were determined at baseline and after 8 weeks.

2.3. Design and intervention procedures

All enrolled participants were randomly assigned to the SCIT group and psychoeducation group (control group) using a computer-generated list of random numbers. All participants in both groups were subjected to the intervention weekly for 8 weeks. Both the SCIT and psychoeducation groups underwent 8 training sessions, and each session lasted two hours. Our main goal was to observe the impact of the intervention on the clinical symptoms and functioning of the patients with BD. Dr. Chan RC first translated the SCIT manual into Chinese to ensure that this manual is suitable for the Chinese culture and psychotic patients (Chan et al., 2010); then, Dr. Chan RC provided the SCIT Chinese version for our study. Two therapists were trained by Dr. Chan, who underwent a training program by the original SCIT developer. Both therapists administered the training trial of the SCIT to maintain the quality of the intervention after completing the training program. Another two experienced psychiatrists who were blinded to the interventional conditions administered all assessments to the subjects at both baseline and the endpoint. The interrater reliability of the HDRS-17, YMRS, FAST and neurocognitive measures had good agreement (the interclass correlation coefficients were higher than 0.80).

2.3.1. SCIT intervention

SCIT is a manual-based treatment intervention developed to address social cognitive dysfunction in patients with psychotic disorders (Penn et al., 2005). A study conducted in Finland reported that the modified SCIT program is feasible and acceptable for patients with psychotic disorders (Voutilainen et al., 2016). Chan et al. condensed the SCIT protocol from a 15-week program to a 9-week program to maintain its suitability for Chinese adults, and the modified SCIT demonstrated better feasibility and efficacy in patients with schizotypal personality in China (Chan et al., 2010). After discussion with Dr. Chan, we slightly modified the SCIT to an 8-week program (we omitted the first-week session with a general introduction of SCIT) but maintained the original content to ensure that the program was more appropriate and relevant to all subjects. These eight training sessions consisted of the following three phases: understanding emotions (3 sessions), social cognitive biases (3 sessions), and integration (2 sessions). Each session lasted two hours, and the sessions were held weekly.

2.3.2. Psychoeducation

We were authorized to use the Psychoeducation Manual for Bipolar Disorder from Dr. Vieta E. who is one of the authors of this manual. In addition, we referred to Colom F's publication and administered the psychoeducation program to determine the intervention quality according to the requirement of the Manual. The psychoeducation manual for bipolar disorder consists of illness awareness (1 session), treatment adherence (2 sessions), detection of early warning signs (2 sessions), substance misuse avoidance (1 session), and lifestyle regularity (2 sessions) (Colom et al., 2003; Colom and Vieta, 2006). Similarly, each session lasted two hours, and the sessions were held weekly.

2.4. Statistical analysis

The data analyses were performed with SPSS for Windows version 16.0 (SPSS, Chicago, IL, USA). A chi-square test and independent samples t-test were used to compare the demographic variables between the SCIT group and control group as applicable and appropriate. In addition, an independent samples t-test was conducted to compare the differences in the HDRS, YMRS, FAST and neurocognitive measures between the two groups using the baseline data. Repeated-measures analyses of variances were conducted to assess the impact of the two different interventions on the FAST total scores and six domains, clinical symptoms and neurocognitive measures from the baseline assessment to the postintervention assessment. The intervention-by-time interactions were analyzed to examine the effects of the interventions within and between groups. All statistical tests were two-tailed, and alpha was set at 0.05.

3. Results

3.1. Demographic and distributional characteristics of the study variables

Eighty partially remitted patients with bipolar disorder were recruited. Six patients were dismissed due to incomplete assessments (two patients in the SCIT group), unwillingness to continue (two patients in the SCIT group and one patient in the control group), and side effects (one patient in the SCIT group). Seventy-four participants completed the interventions and all assessments throughout the 8 weeks, including 35 patients in the SCIT group (type I: 31, type II: 4) and 39 patients in the control group (type I: 35, type II: 4). The psychotropic medications prescribed to the partially remitted BD patients were olanzapine (range = 5–10 mg, mean = 5.5, SD = 1.9 mg, $n = 41$), quetiapine (range = 100–200 mg, mean = 107.1, SD = 47.5 mg, $n = 14$), divalproate (range = 600 mg, mean = 599, SD = 0.0 mg, $n = 34$) and lithium carbonate (range = 500–750 mg, mean = 532.5, SD = 84.7 mg, $n = 39$). Other hypnotic medications, such as clonazepam and alprazolam, could not be used because of the presence of cognitive impairment. No differences in the demographic characteristics and the proportion of medication treatments were found between the SCIT group and the control group ($p > 0.05$; see Table 1).

Using the K-S method, we analyzed the normality of all data (baseline data and postintervention data) based on stratification (SCIT and control group), and the results showed that the FAST and neurocognitive measures (baseline and postintervention data) were normally distributed in the two groups (p-value: 0.37–0.99). Furthermore, we found a p-value of only 0.03 for the HDRS postintervention data in the SCIT group and 0.04 for the YMRS baseline data in the control group. Overall, the data distribution did not influence the final analysis, and we performed parametric tests to analyze all variables.

3.2. Comparison of the clinical variables between the groups at baseline

Using independent samples t-tests to analyze the baseline data, we compared the clinical measures of HDRS, YMRS, FAST and its six domains and the neurocognitive measures between the SCIT group and

Table 1
Demographic characteristics of all participants.

Items (%)	SCIT (n = 35) Mean (SD)	Control (n = 39) Mean (SD)	χ^2/t	P value
Gender (female)	20 (57.1%)	18 (46.2%)	0.88	0.35
Age (year)	34.2 (7.1)	34.6 (9.9)	−0.22	0.83
Education level (year)	13.1 (2.2)	13.2 (3.7)	−0.24	0.81
Employed/Unemployed (n)	19/16	22/17	0.03	0.86
Marriage			0.01	0.97
single	11 (31.4%)	13 (33.3%)		
married	20 (57.1%)	21 (53.8%0		
divorced	4 (11.4%)	5 (12.9%)		
Duration of BD (year)	8.7 (5.9)	7.5 (5.7)	0.93	0.36
Family history (yes/no)	5/30	9/30	0.93	0.34
Partial remission (days)	44.1 (11.1)	44.9 (12.4)	0.28	0.78
Monotherapy			0.04	0.98
lithium	4 (11.4%)	4 (10.3%)		
divalproate	6 (17.1%)	7 (17.9%)		
SGA	1 (2.8%)	1 (2.6%)		
Combined therapy			1.88[a]	0.39
lithium + divalproate	0(0.0%)	2(5.1%)		
lithium + SGA	15(34.3%)	15(38.4%)		
divalproate + SGA	9(25.7%)	10(25.6%)		
Type of BD (I/II)	31/4	34/4	0.03	0.87

Note: a represents Fisher's exact test value, SGA: second-generation antipsychotic.

control group. There were no group differences in the HDRS, YMRS and FAST total scores, including the six domains. Similarly, no differences in the neurocognitive measures, including the TMT-A, SDMT, HVLT-R, BVMT-R and SCWT, were found between the groups (all p-values > 0.05; see Table 2).

3.3. Functional improvement from pre- to postintervention

Repeated-measures analyses of variances were conducted to assess the changes over time in the overall sample. We compared the pre- and postintervention assessment of the FAST and its six domains. Our results showed significant differences in the total FAST scores over the eight weeks ($F = 52.4$, df = 1, $p < 0.001$). When the postintervention tests were performed, the total FAST scores in the SCIT group were significantly decreased compared with those in the psychoeducation group ($F = 18.9$, df = 1, $p < 0.001$). Additionally, the SCIT group showed greater improvement in the total FAST scores compared with

Table 2
Comparisons of clinical variables between the baseline groups.

Items	SCIT (n = 35) Mean (SD)	Control (n = 39) Mean (SD)	t	p value
HDRS	3.6 (0.9)	3.7 (1.1)	−0.40	0.69
YMRS	3.3 (1.2)	3.2 (1.1)	0.19	0.85
FAST total	21.8 (1.9)	22.2 (2.1)	−0.81	0.42
-Autonomy	1.4 (0.5)	1.3 (0.5)	0.81	0.42
-Occupational functioning	7.3 (0.8)	7.5 (0.9)	−1.14	0.26
-Cognitive functioning	1.7 (0.5)	1.6 (0.5)	0.85	0.40
-Financial issues	1.7 (0.5)	1.6 (0.5)	0.63	0.53
-Interpersonal relationship	8.0 (1.1)	8.3 (1.0)	−1.26	0.21
-Leisure time	1.7 (0.5)	1.8 (0.4)	−0.75	0.46
TMT-A	38.8 (8.9)	38.6 (10.5)	0.08	0.94
SDMT	46.4 (7.4)	44.4 (13.8)	0.76	0.45
HVLT-R	22.5 (3.4)	21.9 (5.2)	0.60	0.55
BVMT-R	22.7 (3.9)	22.2 (5.5)	0.48	0.63
SCWT	183.5 (22.6)	171.8 (35.2)	1.68	0.10

Note: TMT-A (the Trail Making Test-A); SDMT(Symbol Digit Modalities Test); HVLT-R(Hopkins Verbal Learning Tests-Revised); BVMT-R(Brief Visuospatial Memory Test-Revised); SCWT(Stroop Color-Word Test).

Table 3
The comparisons of all variables between/within groups.

	SCIT group (n = 35)		Control group (n = 39)		F1 (within group) (p value)	F2 (within group) Prepost*group (p value)	F3 (between group) (p value)
	Pre-	Post-	Pre-	Post-			
HDRS	3.6 ± 0.9	2.8 ± 0.8	3.7 ± 1.1	3.3 ± 0.8	38.2 (<0.001)	4.7 (0.03)	2.6 (0.11)
YMRS	3.3 ± 1.2	2.5 ± 0.8	3.2 ± 1.1	3.1 ± 0.9	11.2 (0.001)	7.3 (0.009)	1.6 (0.21)
FAST	21.8 ± 1.9	19.3 ± 1.7	22.2 ± 2.1	22.7 ± 2.1	52.4 (<0.001)	130.6 (<0.001)	18.9 (<0.001)
Aut.	1.4 ± 0.5	1.2 ± 0.4	1.3 ± 0.5	1.4 ± 0.5	2.4 (0.13)	12.2 (0.001)	0.2 (0.62)
Ocu.	7.3 ± 0.8	6.6 ± 0.7	7.5 ± 0.7	7.7 ± 0.8	13.8 (<0.001)	29.4 (<0.001)	13.7 (<0.001)
Cog.	1.7 ± 0.5	1.6 ± 0.5	1.6 ± 0.5	1.8 ± 0.4	0.8 (0.38)	9.7 (0.003)	0.4 (0.51)
Fin.	1.7 ± 0.5	1.5 ± 0.5	1.6 ± 0.5	1.7 ± 0.5	3.9 (0.06)	11.2 (0.001)	0.3 (0.61)
Inter.	8.0 ± 1.1	6.9 ± 0.8	8.3 ± 1.0	8.4 ± 0.9	38.1 (<0.001)	50.6 (<0.001)	18.1 (<0.001)
Leisure	1.7 ± 0.5	1.5 ± 0.5	1.8 ± 0.4	1.8 ± 0.4	1.8 (0.20)	8.1 (0.006)	3.1 (0.08)
TMT-A	38.8 ± 8.9	38.7 ± 7.1	38.6 ± 10.5	40.0 ± 8.1	0.9 (0.34)	1.1 (0.30)	0.1 (0.77)
SDMT	46.4 ± 7.4	46.9 ± 7.5	44.4 ± 13.8	42.3 ± 7.9	0.4 (0.51)	1.3 (0.26)	2.9 (0.09)
HVLT	22.5 ± 3.4	24.0 ± 2.5	21.9 ± 5.2	21.9 ± 3.5	4.7 (0.03)	5.0 (0.03)	2.9 (0.09)
BVMT-R	22.7 ± 3.9	24.6 ± 3.1	22.2 ± 5.5	22.3 ± 4.5	7.7 (0.01)	6.2 (0.02)	2.5 (0.12)
SCWT	183.5 ± 22.6	184.6 ± 13.2	171.8 ± 35.2	177.7 ± 19.7	1.4 (0.26)	0.6 (0.43)	3.8 (0.054)

Note: F1 represents differences of change within the group, F2 represents interaction of prepost*group (pre: before intervention, post: after intervention); F3 (post hoc tests) represents endpoint differences between the two groups.
Aut: Autonomy, Occ: Occupational functioning, Cog: Cognitive functioning, Fin: Financial issues, Inter: Interpersonal relationship, Leisure: Leisure time.

the psychoeducation group ($F = 130.6$, df = 1, $p < 0.001$). Similarly, we analyzed the changes over time in the six domains of the FAST, and only two of the six domains, i.e., occupational domain ($F = 13.8$, df = 1, $p < 0.001$) and interpersonal domain ($F = 38.1$, df = 1, $p < 0.001$), were found to significantly differ between the preintervention and post-intervention timepoints. The interaction between group and time revealed that the SCIT group showed superiority over the psychoeducation group in all six domains (see Table 3).

3.4. Clinical and neurocognitive changes from pre- to postintervention

The repeated-measures analysis revealed that the HDRS ($F = 38.2$, df = 1, $p < 0.001$) and YMRS ($F = 11.2$, df = 1, $p = 0.001$) scores significantly improved over the 8 weeks. The interaction between training allocation and time (preintervention and postintervention) revealed that the SCIT group exhibited greater improvement in the HDRS ($F = 4.7$, df = 1, $p = 0.03$) and YMRS ($F = 7.3$, df = 1, $p = 0.009$) scores compared to the psychoeducation group.

Similarly, across the entire sample, only HVLT-R ($F = 4.7$, df = 1, $p = 0.03$) and BVMT-R ($F = 7.7$, df = 1, $p = 0.01$) significantly improved from pre- to postintervention. Regarding the differences in the changes between the groups, the neurocognitive measures in the SCIT group showed significant improvements over the psychoeducation group in the HVLT-R ($F = 5.0$, df = 1, $p = 0.03$) and BVMT-R ($F = 6.2$, df = 1, $p = 0.02$) scores (see Table 3).

4. Discussion

The main goal of this randomized, controlled, rater-blind, 8-week clinical intervention was to examine the association between Social Cognition and Interaction Training (SCIT) and improvement in emotional and functional measures among partially remitted patients with bipolar disorder. We compared the differences in functioning and emotional symptoms over time, and our findings show that the SCIT group had significant improvements in clinical symptoms and functioning compared to the psychoeducation group.

Our present study mainly evaluated the effect of SCIT intervention on total functioning. The FAST was used to assess total functioning in BD. Our findings revealed that the SCIT group had a small reduction in the FAST total scores compared to the psychoeducation group at 8 weeks. Furthermore, the functional improvement following SCIT was greater than that following psychoeducation. Previous studies have reported that SCIT could improve social functioning in patients with stable schizophrenia and psychotic disorder (Roberts et al., 2014; Wang et al., 2013), supporting the efficacy of SCIT on social functioning.

Lahera et al.'s findings show that the SCIT group had a small decrease in FAST scores and moderate increase in GAF scores after a three-month intervention in BD patients (Lahera et al., 2013). However, in this study, the slight improvement in the FAST total scores could not indicate a clinically meaningful outcome, but the short intervention (8 weeks) may have weakened the functional recovery.

In the current study, we assessed overall psychosocial functioning, including the occupational, interpersonal relationship, cognitive functioning, autonomy, financial and leisure time domains. Our findings show that SCIT was superior to psychoeducation in improving the occupational and interpersonal relationship domains. Some studies have suggested that patients with BD generally exhibit impairments in both vocational functioning and interpersonal relationships, even in euthymia (Mehta et al., 2014; Rosa et al., 2011; Samalin et al., 2016). The improvement in these two areas could also benefit economic autonomy and financial management (Torrent et al., 2013). SCIT is a psychosocial approach combined with social cognitive improvement. SCIT has been found to be effective in recognizing negative emotions and improving social functioning in patients with schizophrenia in a real-world community (Gordon et al., 2018). Miklowitz et al. reported that intensive psychosocial interventions could restore the disadvantages in relationships and working capacity over 9 months (Thomas, 2007). We speculate that SCIT targets the promotion of judgment ambiguity and difficulty in work settings (Bartholomeusz et al., 2013), and this training program encourages participants to interact with other members to perform tasks (such as role play tasks) in which they could learn more social skills with other group members.

Compared to the psychoeducation group, a significant enhancement in the HDRS and YRMS scores was observed in the SCIT group, supporting the efficacy of SCIT on clinical symptoms in patients with bipolar disorder (Hassonohayon et al., 2014; Voutilainen et al., 2016). A previous study demonstrated that patients with BD could have impairments in facial expression, emotional recognition and hinting of tasks (Samamé et al., 2012). A meta-analysis further showed the same apparent deficits in patients with BD (Bora et al., 2016). SCIT may restore negative emotion by improving the biased attributional style and emotional perception. In addition, SCIT could teach participants how to recognize negative emotion and how to consolidate this interaction with all exercises in individuals with schizophrenia (Roberts et al., 2010). Similarly, patients with BD have been shown to have emotional processing biases and social cognition deficits (Bilderbeck et al., 2016). Unfortunately, we did not perform social cognitive measures, which could explain the mechanism by which SCIT improves social functioning in BD patients. However, some previous studies have shown that SCIT is effective at improving various social cognition domains in

individuals with schizophrenia (Roberts et al., 2014). Szmulewicz et al.'s finding revealed that social cognition could be associated with the improvement in emotional and social functioning in BD patients (Szmulewicz et al., 2019). Thus, we speculate that SCIT changed the FAST score by improving social cognition. Our study aimed to explore whether SCIT is associated with improvement in psychosocial functioning and neurocognition in BD patients, and we hope to further confirm the relationship between social cognition and social functioning in our future research.

Similarly, we found that compared to psychoeducation, SCIT yielded small improvements in verbal learning and visuospatial memory, and our findings showed greater improvement in the cognitive domain of the FAST with SCIT. We infer that SCIT is more likely to promote the ability to solve problems in complicated situations, memorize clues, recognize facial expressions and learn new information in group activities, which might indirectly promote the abilities of learning and memory during group training. Some studies have noted that neurocognitive functional training could improve both neurocognitive deficits and social functional impairment in bipolar or schizoaffective disorder (Bonnin et al., 2016; Torrent et al., 2013). To date, the association between SCIT and neurocognitive deficits in BD has not been reported. Thus, our outcomes could not clearly explain this possible correlation, which remains to be elucidated.

Our study also has some limitations. First, although the distribution of the medication treatments was controlled for between the groups, the possible effect of mood stabilizers and antipsychotics on cognitive performance should be considered because some research has shown that psychotropic medications could worsen cognitive performance, such as attention and memory ability (Pompili et al., 2015). Second, although the average scores of all variables met the symptomatic remission criteria, the improvements in all symptomatic measures were less than 1 or 2 points. The short-period intervention may have delayed improvements in clinical symptoms and functioning, which could weaken the clinical significance of the study. Third, the lack of social cognitive measures could weaken the reason why social functioning was improved by SCIT intervention. Previous studies have reported that SCIT could improve social functioning by altering Theory of Mind (ToM) (Lahera et al., 2013), and this mediation of social cognition should be explored in further research. Fourth, due to the absence of treatment as usual (TAU) as a placebo group, pharmacological effects could not be completely excluded. Finally, the SCIT intervention lasted only eight weeks, and the current findings cannot predict long-term outcomes.

In conclusion, our results suggest that SCIT is a feasible and promising intervention for improving the clinical symptoms and functioning of partially remitted patients with bipolar disorder in China. Our findings provide preliminary evidence that SCIT is superior to psychoeducation in improving clinical symptoms and functioning. Further research should examine the long-term impact of SCIT on total functioning in euthymic patients with bipolar disorder.

Ethics statement

All participants gave their written informed consent according to the protocol approved by the Ethics Committee of Tianjin Anding Hospital.

Author contributions

Yong Zhang was involved in the study design, data analysis and writing of the manuscript. Xiaojuan Ma and Jian Zhang developed the study and drafted the paper, Sixiang Liang, Wenwen Yu, Qianqian He and Yanhui Bian contributed to the data collection. All authors contributed to revision of the manuscript and take responsibility for the integrity of the data and the accuracy of the data analysis.

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