Original Article

Facial Emotion Recognition in Adolescents with Bipolar Disorder

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Object: Bipolar disorder (BD) is associated with abnormalities in emotional competence. One of the main aspects of this competency is emotion recognition which is presented in the face. This study aimed to evaluate facial emotion recognition in adolescents with bipolar disorder when they are free of acute symptoms.
Method: Thirty patients diagnosed with BD aged 12 to 18 were selected from a large sample of consecutive admitted adolescents in Roozbeh hospital. They were compared with 30 matched normal developing adolescents who were recruited from mainstream schools at Tehran. All participants were evaluated using a facial emotion recognition task. The participants needed to recognize happy, sad, angry and neutral facial expressions The ANOVA was used to analyze the differences between the two groups in terms of emotion recognition variables.
Results: The patients with BD showed a significant deficit in recognizing emotions in general (p=.01) which was prominent in the angry faces. Their response time to recognize the facial expressions was longer compared to the normal individuals. This difference was significant in recognizing the happy and neutral faces ($p<0.05$).
Conclusion: This study suggests an inaccurate recognition of facial expressions in adolescents with BD, particularly for anger, as well as slowness in detecting emotions especially happiness.

Keywords: *Bipolar disorder, facial emotion recognition, adolescents*

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Bipolar disorder (BD) which is not uncommon in youth (1) is often characterized by continuous, rapid-cycling, irritable, and mixed symptoms of depression and mania or hypomania. It may co-occur with disruptive behavior disorders, particularly attention deficit hyperactivity disorder (ADHD) or conduct disorder (2). Youths with BD may be explosive and irritable during a mood episode (3) and may have significant impairments in their academic functioning at school (4) and in interpersonal relationships with peers and family (5).

One of the main components for irritable mood in patients with BD is emotional dysregulation (ED) which is defined as an emotional response which is poorly modulated, and does not fall within the conventionally accepted range of emotive response. ED may be referred to labile mood or mood swings as well (6).The irritability associated with PBD may be an important mechanism of this deficit and may thus represent a major target for treatment (7) Besides the literature supporting ED in pediatric bipolar disorder (PBD), there are new findings which highlight the importance of emotion recognition deficits in this disorder. The ability to recognize facial emotional expressions is a fundamental skill, necessary for successful social interaction. This ability is an innate feature that develops extensively throughout early stages of childhood development. Ability to produce and recognize facial expressions of emotion is an important component of interpersonal communication that makes problems in bipolar patients (8). Certain facial expressions such as happiness, sadness, angry, fear and disgust have been evaluated in patients with bipolar disorder (9)

Degabriele et al. (2010) found that adult patients with BD in manic phase demonstrated faster responses to happy faces compared to sad faces, whereas there was no emotional discrimination in the control group (10).Functional imaging studies of adults with BD showed dysfunction within subcortical (striatal-thalamic) and associated limbic regions (11) as well as other abnormalities including over activity in anterior limbic structures in response to fearful or happy facial expressions (12). Some researchers suggest that these parts of the brain show impaired functioning even during euthymic period. Another

functional MRI analyses showed that adult patients with BD, compared to a control group, had increased activation in the striatum and anterior cingulate cortex when successfully encoding happy faces and in the orbitofrontal cortex when successfully encoding angry faces (13).

Exaggerated medial prefrontal cortical and subcortical (putamen and amygdala) responses to emotional signals may represent their table neurobiological abnormalities underlying BD. Thus, efforts have been directed towards understanding the cognitive and emotional characteristics of children with PBD. McClure et al. examined 11 children with BD (mean age of 13.7 years), 10 children with anxiety disorders (mean age of 12.9) and 25 children as control group (mean age of 13.5) on tests of facial memory and emotion identification (8).The emotion identification task consisted of 24 photographs of adults and 24 photographs of children in both high and low intensities of happiness, sadness, anger and fear. The patients with BD made more errors in identifying low-intensity faces compared to the normal and anxious groups of children. They also made more errors in recognizing children's faces, over-identifying them as angry faces.

Voelbel et al. described that children with BD had problems with identifying emotion in faces, but they did not specify which emotion was more inaccurately identified (14).

Shankman et al. found that a group of 9 to 18 year old children and adolescents with PBD type I, who were euthymic for a minimum of 4 months, presented reduced activation of right ventro-lateral pre frontal cortex and increased activation of anterior cingulate, amygdala, and paralimbic cortex in response to both angry and happy faces compared to neutral faces. They also showed reduced activation of visual areas in occipital cortex and greater activation in higher – order visual perceptual areas, including superior temporal sulcus and fusiform gyrus with angry faces and posterior parietal cortex with happy faces (7)

Although the recent studies have reported impairments on tests of face and facial emotion recognition in BD, their findings are still somewhat limited and mixed. Since patients with BD show multiple psychosocial problems even after the remission of their mood symptoms, it is interesting to study the probable persistence of facial emotion recognition deficit even during the euthymic phase of the disorder (14).

This study aimed to evaluate the emotion recognition ability in adolescents with bipolar disorder when they are free of acute symptoms compared to normal developing adolescents.

Material and Methods

Participants

Thirty 12 to 18 year old adolescents (16girls and 14boys) admitted to the child and adolescent psychiatry ward in Roozbeh hospital were recruited consecutively. The patients were selected based on diagnosis of bipolar disorder, manic episode according to the DSM-IV-TR criteria made by child and adolescent psychiatrists. The diagnosis was then confirmed using the Kiddie-Schedule for Schizophrenia and Affective disorders (K-SADS).

A total number of 30 healthy controls matched on sex and age were also recruited as the available sample from secondary schools in Tehran.

All the participants were students at mainstream schools with normal IQs based on their academic achievements.

Major neurological disorders, head trauma, mental retardation and substance use disorder were considered as exclusion criteria for the both groups based on information obtained from their parents.

Measures

Facial Emotion Recognition Task (FERT)

A computerized facial emotion recognition task developed by the authors based on Cohn-Kanade face database was used in this study (15). A total number of 100 faces divided randomly to happy, sad, angry and neutral expressions were shown to the participants. Each emotion was repeated 25 times randomly using two females and three males' faces. Each picture with the resolution of 397*425 was being presented for 2500-2700ms with an interval of 1500 ms. The participants were instructed to press four colored buttons which showed the mentioned emotions (red for happy, blue for sad, yellow for angry and green for neutral faces).All the participants were trained how to use the buttons before they started the task. There was an example block containing 6 pictures which were repeated twice to familiarize the participants with the task. These example pictures are not included the main task. The number of correct responses and the time taken to response were considered as variables.

Children Depression Inventory (CDI)

The CDI is a valid (16) 27 item self-report inventory of childhood depression that taps a variety of depressive symptoms in children aged 7 to 17; Kovacs reported its alpha reliability coefficient ranging from 0.71 to 0.86 (17).Test-retest reliability and internal consistency of CDI for Iranian population were reported as 0.8 and 0.89,respectively (18).

Young Mania Rating Scale (YMRS)

The Young Mania Rating Scale (YMRS) is one of the most frequently utilized rating scales to assess manic symptoms. The scale has 11 items and is based on the patient or therapist's reports of his or her clinical condition over the previous 48 hours. Additional information is based upon clinical observations made during the course of the clinical interview. Young reported the validity coefficient of 0.41 to 0.85 and reliability coefficient of 0.88 to 0.9 (19).The validity and reliability of YMRS is acceptable in Iran (20).

Conners' Parent Rating Scale (CPRS)

The Conners Parent Ratings Scale (CPRS) is a standard instrument for assessment of attention deficit-

hyperactivity disorder (ADHD) and related behavior problems in children and adolescents aged 3 to 17. The psychometric properties of the parent version of this instrument (CPRS) have been studied in an Iranian clinical population compared to normal children. It was found that the CPRS could discriminate children diagnosed with ADHD from non-affected individuals (P<0.001) (Tehrani-Doost et al, unpublished).

The Kiddie- Schedule for Affective Disorders and Schizophrenia (K-SADS)

It is a semi structured diagnostic interview to assess current, past and lifetime diagnostic status in children and adolescents (6-18 years) (21).The different components of the K-SADS have been reported by Kaufman et al. (21); and the psychometric properties of its Persian version sound good to excellent for most major psychiatric disorders(22).

Procedure

The K-SADS was used to confirm the bipolar diagnosis and to assess any other psychiatric disorders in the BD group. The participants were interviewed by a trained psychologist. To evaluate the severity of probable inattentive or hyperactive/impulsive symptoms, the parents were asked to complete the CPRS. To evaluate the existence and severity of depressive symptoms, all participants in the BD group were asked to complete the CDI. During the 10 to 14 days after admission, the YMRS was completed for each patient by a clinical psychologist, and if the scores were lower than 10, the mood symptoms were defined as remitted and the patient was asked to do the facial emotion recognition test.

All the control participants were assessed for any psychiatric disorders, using the K-SADS. The parents completed the CPRS to rate the inattentive-hyperactive impulsive symptoms in their children. The adolescents were excluded from the control group if their CPRS scores were above 65 or had any other major psychiatric disorders. All the participants were evaluated at the neuro cognitive laboratory of Roozbeh Hospital between10 am to 12 midday.

The study was approved by the Ethics Committee of Tehran University of Medical Sciences and conforms to the provisions of the Declaration of Helsinki. The aims and the stages of the study were explained to the participants and their parents and if they agreed to participate, written consents were obtained.

Statistical Analysis

Data from the Facial Emotion Recognition Task were analyzed using the ANOVA to find the differences between the two groups.

Results

Group characteristics for the bipolar disorder group (BDG) and the control group (CG) are summarized in Table 1. The two groups were matched by age, gender and depressive scores .

The majority of the participants in the BDG were receiving mood-stabilizing medication. The most prescribed medication was lithium [22/31]. Two patients were on sodium valproate, three patients were on the combination of these 2 medications and four patients took other medications related to bipolar disorder. Nearly all the participants with bipolar disorder had the history of ADHD before the emergence of bipolar disorder, and the t-test between the two groups in terms of the CPRS subscales showed a significant difference [P< .001].

Table 1: Demographic and clinical characteristics of the two groups

	Bipolar (M±SD)	Control (M±SD)	P
Age	15.43±1.27	15.07±1.57	0.55
CDI[1]	14.4±7.13	13.3±6.7	0.32
YMRS[2]	8.63±5.4		
CPRS[3]			
Oppositionality	66.58±12.92	47.7±7.55	**0.001**
Hyperactivity	62.27±12.02	48.03±7.37	**0.001**
Inattentivness	71.65±13.75	51.28±13.78	**0.001**
ADHD index	65.46±13.99	50.19±7.68	**0.001**

[1]Covacs Depression Index
[2]Young Mania Rating Scale
[3]Conners Parent Rating Scale

Table 2: Comparison between the two groups in terms of FERT variables

	Bipolar (M±SD)	Control (M±SD)	F	P
Accuracy of Recognition (total)	84.96±9.55	91.1±4.2	3.2	**0.002**
Response time (total)	2143.24±984.08	1662.85±517.04	2.35	**0.02**
Accuracy of Recognition (anger)	0.72±0.22	0.85±0.13	7.76	**0.007**
Response time (anger)	2361.85±923.71	1952.93±697.23	3.65	0.06
Accuracy of Recognition (happy)	0.96±0.05	0.98±0.03	3.2	0.07
Response time (happy)	118.66±137.99	1181.21±133.31	7.84	**0.007**
Accuracy of Recognition (sad)	0.77±0.15	0.83±0.11	3.13	0.08
Response time (sad)	8654.29±327.57	2053.309±939.14	1.22	0.27
Accuracy of Recognition (neutral)	0.94±0.09	0.96±0.06	1.43	0.23
Response time (neutral)	2039.51±1003.33	1463.36±418.97	8.34	**0.005**

The total number of emotions detected correctly was significantly lower in adolescents with bipolar disorder [F=3.2, p=.002]. The total time taken to recognize emotions was significantly longer in the patient group compared to the control group [F=-2.35, p=.02]. The analysis of the accuracy of recognition of each emotion showed no significant differences between the two groups, except for anger which was significantly lower in patients with BD compared to their matched controls [F=3.2, p< .01]. The correct detection of happy and sad faces was also lower in bipolar group.

These differences were nearly significant. [Fhappiness=3.2, P=0.07; F sadness=3.13, P=0.08].

To explore the response time of recognizing different emotions in the two groups, the analysis showed that the CG's response to happy faces was faster than the BDG's [F=7.84, P<0.01]. The time to recognize neutral faces was significantly longer in adolescents with bipolar disorder compared to normal developing adolescents [F=8.34, P<0 .01].

The time taken to recognize angry faces was also longer in patients with BD, but this difference was nearly significant [F=3.65, P=0 .06] (Table 2).

Discussion

Children and adolescents with bipolar disorder experience more rejection and social problems than healthy youths (23). Research on adults with BD suggests that the misinterpretation of nonverbal cues such as facial expressions may contribute to such social impairment even after the mood symptoms remission. The ability to recognize facial emotional expressions is a fundamental skill that is necessary for successful social interaction and mood regulation. Since previous studies examining this competency in patients with BD have generated mixed results, this study was aimed to further elucidate the emotion recognition deficits in children with this disorder when they are not in acute phase of mania.

In contrast to some other studies (24) (25), our results confirmed that adolescents with BD showed overall deficits in the accurate identification of emotions. The detection of emotion was significantly lower in the patient group compared to normal adolescents while they were viewing angry faces. This ability was also (nearly significant) lower while they needed to recognize sad and happy faces. Moreover, the time taken to detect emotional faces was longer in adolescents with BD compared to the normal developing adolescents. This process was particularly slower in identifying happy and neutral faces. These findings could be interpreted that youths with bipolar disorder have some problems in recognizing emotional faces in terms of accuracy and speed even when they are free from acute symptoms. This finding is congruent with the results of studies (26) showing the persistence of social impairment during euthymic periods.

There are some other findings in the literature (25) suggesting that individuals with bipolar depression were less likely to identify angry faces than the euthymic BD group which is slightly different from our findings. In another study (8) it was found that adolescents with bipolar disorder over identified emotional faces as anger. Vaskkin reported no differences in recognizing facial expressions between the BD and the control groups (4).

On the other hand, there are some results (10) showing that adults with BD have a faster response to happy faces. Nonetheless, adolescents with BD in this study responded slowly to happy and neutral faces. This difference could be referred to the existence of elated mood in adults compared to the irritability seen in the adolescents. Therefore, adults with BD may detect happy faces more easily compared to adolescents. Moreover, the adult patients were examined in such studies during their manic phase which may have influenced their recognition of happy faces while we evaluated adolescents with euthymic mood. This difference may also be attributed to the developmental differences in recognizing emotions. Further studies are needed to elaborate the ability to detect emotional faces in different age groups with bipolar disorder .

The findings of our study should be interpreted in the light of its limitations such as small sample size and not grouping the participants in different age and gender groups. Moreover, the majority of patients with BD in the present study were receiving lithium, a medication with approved effect on controlling aggression and irritability. This factor might have affected the profile of emotion recognition. However, decreased discrimination of anger was still apparent in a subgroup of patients who were not receiving lithium. It is noteworthy to assess whether the other mood-stabilizers have the same effect. In addition, our participants were recruited from a referral inpatient center with severe forms of BD, so the results may not be generalized to other youths with mild to moderate symptoms.

In conclusion, our findings show that adolescents with bipolar disorder may have some impairment in recognizing emotions, especially anger. There has also been found that these patients are slower in recognizing emotions, particularly happy faces compared to normal developing adolescents. These results need to be confirmed using the functional neuroimaging methods to explore the exact mechanism underlying emotion recognition in this group.

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