A Comparative Study on Fear Expression Recognition Characteristics in First-episode Schizophrenic Patients

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ABSTRACT

Objective: To explore the characteristics of fear expression recognition in the patients with first-episode schizophrenia.

Methods: Based on the case-control design, the Ekman facial expression database was used to research the subjects' overall response rate of low / high fear facial expression, accuracy rate of low / high level fear and its response time in the control group (28 cases) and the first-episode schizophrenic patient group (27 cases) with matching gender (p = 0.696), age (p = 0.255) and education level (p = 0.895).

Results: The high level fear accuracy rate (50.41 ± 6.18) of case group was lower than that of the control group (68.29 ± 4.27, p = 0.034). The response time (362.84 ± 25.23) of low-level fear of healthy control group was positively correlated with the accuracy rate (21.79 ± 2.28) (r = 0.494, p = 0.008); the negative symptom of case group (23.35 ± 10.56) was negatively correlated with the accuracy rate of high level fear (r = -0.428, p = 0.042).

Conclusion: The patients with first-episode schizophrenia have the disorder of high-level fear recognition and the accuracy rate of fear facial expression recognition can reveal the negative symptoms of the patients.

Keywords: First-episode Schizophrenia; Facial Expression Recognition; Response Time; Fear Expression

Schizophrenia is often accompanied by thinking, emotion, behavior, and cognitive disorders, and the schizophrenic symptoms can be divided into positive symptoms, negative symptoms, cognitive
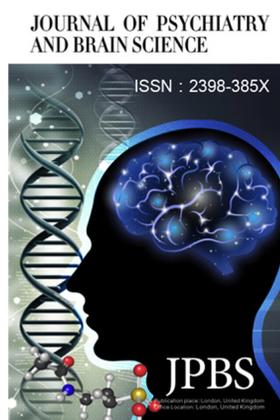
symptoms and emotional symptoms [1]. The emotional symptoms of schizophrenia patients can be expressed as the discordance between inner emotional experience and exterior environment. The treatment of facial expression by schizophrenia patients is different from that of the normal subjects [2]. Increasingly, Increasingly, schizophrenia patients' abilities were damaged in recognizing all kinds of facial expressions, but there exist differences among them [3], and in all facial expressions, the incidence rate of fear-based negative emotion recognition disorders was significantly higher than that of positive emotions, like happiness [4]. Habel, *et al.* [5] pointed out that this recognition difference existed in the American population. Vai, *et al.* [6] also reported that the fear-based facial expression recognition defect also existed in the European population. In China's studies, Yang, *et al.* [7] found that the schizophrenic inpatients had a low recognition rate for the aversion, but the difference of fear recognition rate was not significant. Hence, China has not yet clearly explored the characteristics of low fear recognition rate for schizophrenia, especially whether such is universal in the first-episode schizophrenia. In this study, the

universality and relationship between first-episode schizophrenia and emotional treatment injury was demonstrated by comparing the recognition status of fear expression of first-episode schizophrenia patients.

1 SUBJECTS AND METHODS

1.1 Subjects
Thirty patients with schizophrenia and thirty healthy volunteers were collected in this study. To prevent the subjects from random answers, the subjects whose response rate was lower than 60 % were considered to be uncooperative and removed (one case in health group and one case in study group). The subjects who failed to complete all tests were removed (one case in health group and two cases in study group). The composition of schizophrenic patients and healthy controls, including gender, age, and education level, was not statistically different, see Table 1.

Table 1. Basic Information of Healthy Control Group and Study Group

Variable	Control Group	Study Group	Kruskal Wallis Test
Gender	16F / 12M	14F / 13M	0.696
Age	26.79 ± 1.142	24.81 ± 1.392	0.255
Education Level	12.61 ± 0.389	12.85 ± 0.458	0.895

The patients of first-episode schizophrenia group were all from the outpatient department of Shanghai Mental Health Center from December 2015 to December 2016. They complied with the diagnostic standards of schizophrenia in Diagnostic and Statistical Manual of Mental Disorders (DSM-IV). The disease course of the patients who did not take medications was shorter than two years, and the patients' IQ was more than 70 assessed on the Wechsler Intelligence Scale. The patients or subjects had no mental retardation, nor neurological disease, nor major physical illness; they had no history of alcohol or drug abuse and dependence. They did not receive the MECT, and did not have long-term use of anticholinergic agents, benzodiazepines, and other drugs that may affect the cognitive function.

The volunteers of healthy control groups were all recruited from community volunteers and hospital staff in China, and matched with the patients. Clinical interview for DSM-IV-TR axis T disorder (SCID rating scale) was used to exclude those who have a history of schizophrenia and positive mental disorders. Volunteers' IQ was more than 70, assessed on the Wechsler Intelligence Scale; they had no history of brain trauma, alcohol, or drug abuse and dependence.

This study was approved by the Ethics Committee of Tongji Hospital of Tongji University and the written informed consents were all obtained from the participants.

1.2 Research Methods

1.2.1 General Data Collection and Scale Assessment

The demographic data was collected and surveyed from the subjects of the two groups, including gender, age and education level. The patients were clinically assessed, including the use of PANSS to assess their psychiatric symptoms. The scale assessment performers were two senior doctors from Shanghai Mental Health Center. The Kappa value of the consistency test was 0.87.

1.2.2 Experimental Materials: software E-prime 2.0 was used

The faces used in the experiment were selected from the Ekman standard black-white face database. The facial expression pictures were composed of two male faces and two female faces. The "fear" faces were divided into ten levels according to the extent of performance from 0 % to 100 %.

1.2.3 Experimental Contents: the experiments were designed into blocks

Each block contains 132 trials and each trial was composed of fixation points ("+") and expression pictures. Each picture exposed for 400 ms, followed by fixation points, with an exposure time ranging from 800 ms to 1600 ms. The subjects were required to recognize the expression at this moment by pressing the keys. The patients rested for 10 s at the end of each block, followed by the next experiment. Two blocks were required for each expression recognition experiment, and an experiment lasted about 20 minutes. Each subject was required to

receive the pre-test training for three minutes before taking an experiment.

1.2.4 Statistical Analysis: the data were statistically analyzed using software SPSS20.0. An alpha of 0.05 is used as the cutoff for significance

The "fear" expression was divided into two levels: low-level fear ranged from 0 to 50 % and high-level fear ranged from 51 % to 100 %. The rank sum test was performed on the accuracy rate of low/high-level fears in the case group and the control group. The bivariate correlative analysis was performed on age, gender, group type, education level, low-level fear response accuracy rate, low-level fear response time, high-level fear response accuracy rate, high-level fear response time, PANSS positive symptom score, negative symptom score, general symptom score, total score, and other variables.

2 RESULTS

The recognition accuracy rate of fear expression at different degrees in the two groups was not distributed normally. From the U test, the recognition accuracy rate of high-level fear expression in first-episode schizophrenia case group was lower than that of the control group, and the difference was statistically significant ($p = 0.034$), see Table 2. and Fig. 1. The recognition accuracy rate of low-level fear in the two groups was not statistically significant ($p < 0.05$). The response time of different degrees of fears in the two groups was not statistically significant ($p > 0.05$).

**Table 2. Comparison of Accuracy Rate and Response Time for Fear Expression between Control Group and Case Group**

Group	Low Level Fear		High Level Fear	
	Accuracy Rate (%)	Mean Response Time (ms)	Accuracy Rate (%)	Mean Response Time (ms)
Schizophrenia Group (n = 27)	16.07 ± 2.28	392.69 ± 20.83	50.41 ± 6.18	414.18 ± 25.91
Control Group (n = 28)	21.79 ± 2.28	362.84 ± 25.23	68.29 ± 4.27	374.08 ± 29.46
u test	0.083	0.297	0.034*	0.502

Fig.1 Comparison of High-level Fear Recognition Accuracy Rate between Control Group and Case Group
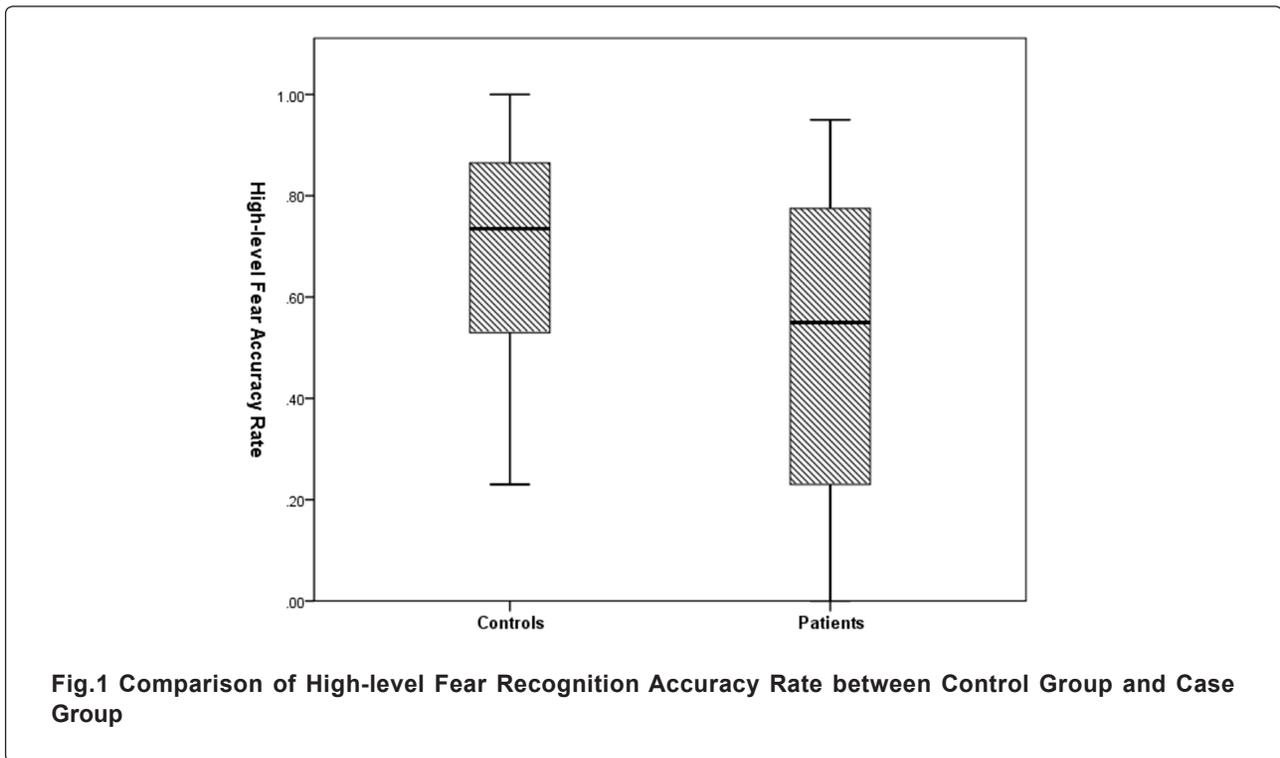
The age, gender and education level of patients in the case group were not significantly correlated with the expression response time and accuracy rate. The response time of low level fear of the volunteers in the control group was positively correlated with the accuracy rate (r = 0.494, *p* = 0.008). The correlative analysis between the accuracy rate and response time and the clinical symptom of the case group was further performed. The positive symptom score

(24.74 ± 8.07), general symptom score (48 ± 11.82) and total score (96.18 ± 26.85) of the case group obtained based on the PANSS scale rating were not significantly correlated with the response time and accuracy rate for the expressions of different degrees. The negative symptom score (23.35 ± 10.56) was negatively correlated with the accuracy rate of high-level fear expressions (r = -0.428, *p* = 0.042), see Fig. 2.

Fig.2 Correlation between Low-level Fear Response Time and Accuracy Rate in Control Group, and between Negative Symptom Score and High-level Fear Accuracy Rate in Case Group
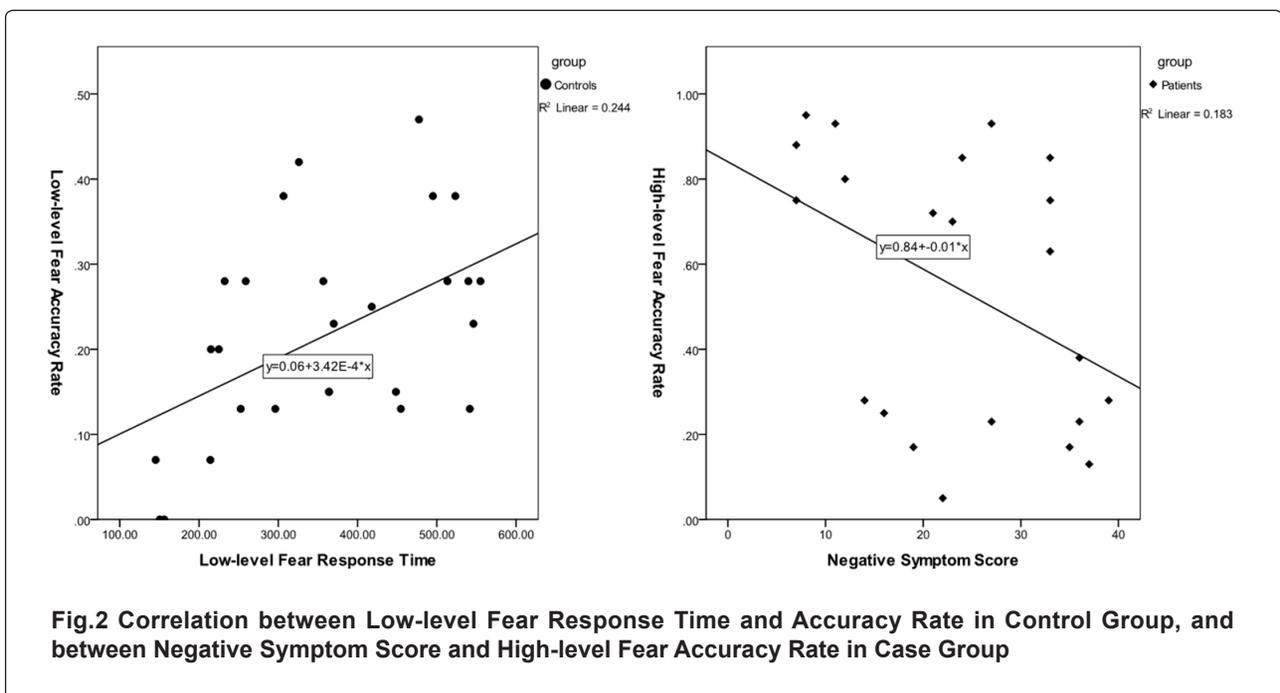
3 DISCUSSION

A significant recognition disorder for fear expressions was found in the patients with first-episode schizophrenia in this study. The high-level fear is relatively easier to be recognized than the low-level fear, but the patients' accuracy rate of recognizing the high-level fear is significantly lower than that of the control group. The negative symptom of the schizophrenic patients is negatively correlated with the recognition accuracy rate of high-level fear expressions.

The basic facial expressions include pleasure, disgust, fear, anger, sadness, etc.[8] The schizophrenic patients' ability to recognize all expressions is damaged[9], but their recognition ability of the fear expressions is significantly worse than other emotions, The recognition ability of fear face was corrected with the positive / negative symptoms, emotional symptom, and recognition symptoms[6]. It is presumed that the performance of both patients and controls is not ideal due to difficulty in recognizing the low-level fear expressions, whereas it is not as difficult to recognize the high-level fear expressions. The low accuracy rate of patient group is more indicative of the facial treatment defects of schizophrenia population of fear expressions. In this study, we observed that the higher score of the patient's negative symptoms reached, there would be the greater indifference of the patients, the lower recognition rate of high-level fear expressions, and the more serious the damage of recognition ability of facial expressions. Some studies show that a low recognition rate of schizophrenic patients for the fear expressions was due to the visual impairment[10]. EEG studies have further shown that the amplitude of patients' occipital lobes P100, N170 and N250 when performing the recognition task of fear facial expressions was less than that of the control group and the latency was shorter than that of the control group[11]. This indicates that the patients shy away from the fear emotion, with a shorter eye contact time when facing a fear face. The schizophrenic patients have more negative emotional experiences[12], but a significantly insufficient recognition of fear expression was found in the schizophrenic patients in this study. In combination with the previous studies, we hypothesize that the patients with first-episode schizophrenia have more eye avoidance in the face of fear expressions, thus resulting in the dysfunction of their facial expression processing system and prone to the false recognition. The amygdale-based limbic system is mainly associated with the fear processing and threat detection. Increasingly, evidence shows that the incomplete activation of amygdale and the disruption of emotional network

function in the schizophrenic patients has impaired the recognition processing of their facial expressions[13-14]. These studies have further confirmed our conclusion. Moreover, the disruption of brain network function requires the schizophrenic patients to mobilize more brain regions to identify the facial expressions[15], therefore, the response time needed is longer than that of the controls. In this study, the average response time of the patients for the low-level or high-level disgust expressions is longer than that of the controls, but the results were not statistically significant. Presumably, this is due to the small sample size.

It was also found in this study that the accuracy rate of the control group increased with the increase of response time to the low-level fear, while there was no similar correlation in the high level fear. Considering that the recognition level of low-level fear is significantly lower than that of the high-level fear, the healthy population needs to increase the response time in order to improve the recognition rate when recognizing the difficult fear expressions. No similar finding was obtained in the study group, which indicates that the patients' recognition ability of low / high-level fear expressions cannot be improved with the prolonging of the response time. Therefore, the patients have defects in recognizing these two levels of fear expressions, and this recognition defect cannot be compensated by prolonging the response time. Moreover, the patients are more likely to recognize the fear expression as other emotions. This further suggests an inherent mechanism defect of recognizing the fear expressions in the patients with first-episode schizophrenia. Furthermore, the correlation analysis shows that the patients' recognition accuracy rate of high-level fear expressions and negative symptoms were negatively correlated, but this correlation does not exist in the scores of positive symptoms and general symptoms. It indicates that the patients with a worse recognition ability of facial expressions may experience more significant emotional indifference, while the emotions of the positive symptom-based patients may not be necessarily impaired.This is consistent with clinical experiences, and additionally, it is also indicates that the positive symptom and negative symptom may be based on different brain functional areas and that they have different brain functional network connections. This is consistent with the current studies[6].

In conclusion, the behavioral analysis of the recognition task of facial fear expressions shows that the patients with first-episode schizophrenia have a disorder of faulty fearful emotion recognition, most evident in the obvious fearful expressions. This

recognition defect cannot be compensated by relying on the increase of response time, and the accuracy rate of fear facial expression recognition can reveal the negative symptoms of the patients. The small sample size is the main defect of this study. The further studies shall need to expand the sample size, increase the follow-up frequency of the patients, and further explore the recognition disorder of fear facial expressions in first-episode schizophrenic patients with respect to anatomy and functional structure, in combination with the magnetic resonance, brain evoked potential, and other means, so as to provide the reference basis for the clinical treatment of the first-episode schizophrenia.

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