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Is There Any Relation Between Impaired Emotion Perception and Thought Disorder in Schizophrenia?

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ABSTRACT

Introduction: Many patients with schizophrenia demonstrate an impaired recognition of emotions as well as thought disorder. However, there may be a correlation between these core impairment domains of schizophrenia. The objective of the present study was to investigate the relationship between the perception of emotion and thought disturbance in schizophrenia.

Methods: The sample consisted of 53 patients with schizophrenia and 38 healthy controls. The Emotions Battery of the University of Pennsylvania Computerised Neuropsychological Test Battery (PennCNP) and the Thought Language Index (TLI) were used to examine the association of the perception of emotion and thought disorders.

Results: Statistical analyses revealed that patients with schizophrenia had poor performance on the recognition of happy, sad, fear, anger, and neutral facial emotion expressions compared to controls. Severity of negative and disorganisation symptoms in schizophrenia patients was found to be related to negative emotions (fear, anger, etc.). Moreover, results revealed that disorganised thoughts are related to misidentification of positive emotions (happy).

Conclusions: Our results suggested that emotion perception disturbances could be associated with disorganised thought in schizophrenia. Impaired recognition and misinterpretation of positive emotions may contribute to the occurrence of disorganised thought.

Keywords: Schizophrenia; emotion perception; thought disorder

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INTRODUCTION

Individuals with schizophrenia exhibit social cognitive impairment including their perception of emotion; the latter refers to perceiving and expressing emotions, and is viewed as a major component of interpersonal interactions (1, 2). Patients with schizophrenia appear to have more difficulty when the tasks involve either recognition, or discrimination of negative emotions (e.g. fear or anger) compared to positive emotions, such as happiness (3–5). Tsoi et al. (6) showed that patients were three times more likely to judge a face as sad when it was not so, and were less able to detect expressions of happiness. Deficits in emotional perception appear to be present early in the course of schizophrenia, stable over time, even evident in the first-degree relatives and also in high-risk subjects, and be related to impairments in psychosocial functioning (7–10).

Deficits in the perception of facial emotion in schizophrenia are related to positive-negative symptoms, disorganization, medication status, and neurocognitive functioning (2, 11). Although there is no agreement regarding the relationship between symptomatology and the perception of emotion, generally patients with positive symptoms might have a tendency to misperceive the emotions of others, whereas patients with negative symptoms might have poorer emotional recognition because of reduced emotional experience (i.e. anhedonia or apathy) or expression (i.e. affective flattening) (12). However, positive symptoms consist of separate dimensions such as reality distortion and disorganization, each of which could have differential relations with social cognition, and also deficits in emotional perception (13)

The dimension of 'disorganization' includes conceptual disorganization, formal thought disorder, mannerisms, posturing, and bizarre behaviour. Formal thought disorder is characterised with the inability to concentrate and connect thoughts logically, overly abstract or concrete responses, derailment (loose associations), unusual or excessive word usage, and impoverishment of speech (14–16). Disorganized and/or impoverished thoughts are predictors of poorer outcome, and also may cause misunderstandings in social interactions and problems in interpersonal communications (17). Furthermore, social cognitive functions that are responsible for accessing information about which emotions are socially appropriate in a given situation may be linked to thought disturbances (16, 18, 19). Several studies have attempted to find a link between the perception of emotion and thought disorder, and they revealed that disorganized symptoms were correlated to the poor ability to perceive emotion, and also social cognition (4, 16, 20–22).

The aims of this study were; 1) to compare the ability to perceive emotion and thought disorders between patients with schizophrenia and control subjects and, 2) to find a link between the severity of symptoms, emotion perception and thought disturbances, and 3) to identify the relation of the ability to perceive emotion with thought disorder in schizophrenia. In our study, we evaluated emotion perception with three different tasks: recognition of facial emotion, discrimination of emotion, and determination of emotional acuity; these tasks are specific for the detection of basic and core emotions such as happiness, anger, sadness,

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and fear. Emotion perception tasks seem to relate to more bottom-up processing than other explicit tasks; thus, their performances could show greater independence from higher cognitive processes (23). For this reason, we preferred emotion perception tasks to other explicit emotion processing tasks such as emotion categorization tasks, and emotion matching tasks. Several studies have tried to identify correlates of the perception of emotion, but few have focused on the relationship between thought disorder, and the ability of emotional perception in schizophrenia. Most of these studies tried to explain the relationship between thought disorders, and the perception of emotion by using with PANNS positive sub-score (4, 20). Because of classical three dimensional PANNS could be problematic in understanding the nature of the relationship between disorganized thought and emotion perception (13), we used the Thought Language Index (TLI), which is a specific measurement of thought disorders, and also five factors model of PANNS to contribute to the understanding of the nature of the relationship between perception of emotion and thought disorder.

METHODS

Participants

Fifty-three patients (35 males and 17 females) with schizophrenia were prospectively recruited from a sample of outpatients' that were monitored with DSM-IV criteria for schizophrenia at the Psychiatry Department of Dokuz Eylül University School of Medicine, Schizophrenia and Psychotic Disorders Programme. Inclusion criteria for patients group were defined as being at least elementary school graduate, and at the range of ages 18–65. Two psychiatrists specialized at psychotic disorders confirmed the diagnoses of schizophrenia. The patients' medical histories were carefully reviewed for eligibility, and patients were excluded if they had a history of comorbid neurological or psychiatric condition, along with schizophrenia. All patients were on antipsychotic medication, and most of the patients were using multiple antipsychotics. We also recruited 38 healthy subjects whose age and educational status matched those of the patients with schizophrenia in order to compare the ability to perceive emotion with the patient group. Healthy controls were recruited via poster advertisement in local community, plus word-of-mouth requests from staff in the hospital. They met the same exclusion criteria as the patients, and they were interviewed and excluded if they if they had experienced a serious head injury, endorsed a neurological or psychiatric disease, or had a history of substance abuse. Based on the Structured Clinical Interview for DSM-IV Axis I Disorders (SCID-I) criteria, there was no current or past psychiatric disorder in the healthy controls. They were also questioned about family history of mental illness, and excluded if a first-degree relative had experienced symptoms consistent with schizophrenia. The research protocol was approved by the Ethics Committee of the university, and an informed consent was received from each participant and their relatives. All participants received first Emotions Battery of the University of Pennsylvania Computerised Neuropsychological Test Battery (PennCNP), and then Thought Language Index (TLI). Patients group also received the Positive and Negative Symptom Scale to determine symptom severity before PennCNP and TLI.

MEASURES

Clinical measures

The Positive and Negative Syndrome Scale: The Positive and Negative Syndrome Scale (PANSS) was used to assess symptom severity. This scale includes a positive syndrome subscale, a negative syndrome subscale, a general psychopathology subscale, and 30 items of the scale are scored on a 7-point Likert scale starting with 0. Recent studies revealed a five-factor model which includes 20 items categorized into positive, negative, disorganized (or cognitive), depressed (or emotional), and excited factors; this is suggested to be a better method compared to the classical three subgroups of symptoms model (the Positive, the Negative, and the General Psychopathology Scale) in the analysis of PANNS data (24). The five-factor model proposed by Wallwork et al. (2012) includes a positive factor (items P1, P3, P5, G9), a negative factor (items N1, N2, N3, N4, N6, G7), a disorganized/concrete (cognitive) factor (items P2, N5, G11), an excited factor (items P4, P7, G8, G14), and a depressed factor (items G2, G3, G6). We analysed our data with this model, and used each dimension from the 5 factor-PANNS in the correlation analysis.

Measures for the perception of emotion

We used the Emotions Battery of the University of Pennsylvania Computerised Neuropsychological Test Battery (PennCNP), which consists of the Penn Emotion Recognition Test, the Penn Emotion Discrimination Task and the Penn Emotional Acuity Test (25).

Penn Emotion Recognition Test (PERT): A computerized task for assessing the recognition of emotion consists of pictures of faces expressing four basic emotions (happiness, sadness, anger and fear), and neutral expressions, all displayed by professional actors. Participants were shown 40 photographs, and asked to identify the correct facial emotion from the five given choices. Independent variables selected for this study were the number of correctly identified expressions (happy, sad, anger, fear and neutral) which recorded separately, as well as the total number of correct responses. In order to determine misattributions, the numbers of false positive responses of these five choices were calculated as independent measures.

Penn Emotion Discrimination Test (PEDT): Using the same facial stimuli used in the Penn Emotion Recognition Test, this task assesses the ability to recognize subtle distinction degrees within happiness and sadness. Independent variables analysed for this study were the number of correctly identified happy and sad faces, as well as the sum of correct answers.

Penn Emotion Acuity Test (PEAT): Participants are asked to rate the emotions of each of 40 photographs in the Penn Emotion Recognition Test on a 7-point Likert scale ranging from very happy to very sad. This test which determines the acuity of two basic emotions sadness and happiness was used to assess the participants' sensitivity in recognising emotions. We used the efficiency score as the independent variable.

Thought disorder measure

The Thought Language Index (26): This task was developed for assessing formal thought disorders. The impoverishment of the thought category includes three items: poverty of speech, weakening of goal, and perseveration. The disorganization of thought category includes five items: looseness, peculiar word use, peculiar sentence construction, peculiar logic, and distractibility. Speech samples are assessed for the presence of these eight types of abnormality. The patient is required to produce eight 1-min speech samples in response to standard stimuli from the Thematic Apperception Test. In the TLI, individual instances of thought or language disorders are assigned by a score of 0.25, 0.50, 0.75 or 1.0, depending on the severity. We analysed the total scores of impoverishment of thought, and disorganization of thought.

Statistical analysis

Variables were plotted and checked for normality of distribution using the Kolmogorov Smirnov test. Because some emotion perception variables have non-normal distribution, we used nonparametric tests for statistical analyses. To compare demographic variables between patients and healthy controls, we used Fisher's Exact tests for independent categorical variables and student t-test for independent continuous variables. We compared PANNS scores, TLI scores, and emotion perception variables between two groups by using Mann-Whitney U-test. The Spearman's correlation coefficients were computed for emotion perception variables (total number of correctly recognised and false positive identified stimuli from PERT, total number of correctly discriminated stimuli from PEDT, acuity score from PEAT), and disorganization and impoverishment scores from TLI. We also performed Spearman's correlations between thought disorder, emotion perception, and clinical variables. Because of the high

correlations between the variables, a Bonferroni correction factor of 13 was applied to correct for multiple comparisons. After this correction, correlations were considered statistically significant at p<0.005 (Pbonf). All analyses were conducted using SPSS (version 21). A significance level of 0.05 was used for all statistical tests, and the two-tailed tests were applied.

RESULTS

Results showed that patients group and healthy control group did not differ in age, education years, and gender (for age, t=0.77 [p=0.34], for years of education, t=-1.87 [p=0.09]), and for gender, Fisher Exact test, [p=0.25]). However, there was a significant trend for the control group to have a higher frequency of being employed than the patient group (Fisher Exact test, p=0.01). The mean age of our patient sample was 35.62 years (SD: 9.72), and the mean age when they suffered their first psychotic episode was 23.62 years (SD: 6.44). Descriptive statistics for age, years of education, and clinical variables such as duration of illness, age of onset, and PANNS scores are shown in Table 1.

Table 1. Demographic and clinical characteristics of the sample

Variable	Sch (N=53) Mean (SD) / N(%)	HC (N=38) Mean (SD) / N(%)	p
Age	35.62 (9.72)	33.86 (10.32)	0.34
Education (years)	11.06 (3.77)	12.42 (3.21)	0.09
Male	35 (67)	21 (55)	0.25 [a]
Percent employed	13 (25)	23 (60)	<0.05 [a]
Duration of illness (years)	11.78 (8.70)	-	-
Age of onset	23.62 (6.44)	-	-
Number of hospitalizations	2.96 (4.10)	-	-
DUP (months)	16.08 (31.59)	-	-
PANSS Negative	17.43 (6.45)	-	-
PANSS Positive	11.00 (5.31)	-	-
PANNS Disorganisation	8.82 (3. 16)	-	-
PANNS Excitement	5.87 (2.56)	-	-
PANNS Depression	7.41 (3.70)	-	-

Fisher Exact test or independent sample t-test, 2 tailed, for significant differences between patients and healthy controls
[a]Fisher Exact test
Sch = Patients with Schizophrenia; HC, Healthy Controls; PANNS, The Positive and Negative Syndrome
Scale; DUP = Duration of untreated psychosis

Patients versus controls: perception of emotion and thought disorder scores

There was a significantly poorer outcome by patients when compared to the control subjects on the TLI, and the perception of emotion tasks. According to the analysis of PennCNP, there was a significant difference between patients and controls in having a poorer performance on PERT, PEAD, and PEAT. In addition, patients with schizophrenia performed more poorly on the recognition of all emotional expressions, which were assessed with the same recognition test (happy, sad, fear, anger and neutral) as compared to the controls. Patients were much more likely to identify emotions as false positives, which indicates their inability to perceive the correct emotion (a patient reporting a happy emotion in a face when the emotion was not happiness indeed might be an example of a false positive happy response). Comparisons between patients and controls are presented in Table 2.

Patients group analyses: the relationship between the perception of emotion, symptom severity and thought disorder

We examined the relationship of dimensions of PANNS with emotion perception. Correlational analysis showed that although positive, depressive, and excited factors from PANNS were not associated with any emotion perception variables, negative factor was found to be related only fear recognition (r=-0.301, p=0.032). Disorganised factor was found to be correlated with several emotion recognition variables. Results revealed that if disorganisation symptom severity is increased, recognition of fearful (r=-0.284, p=0.044) and neutral faces (r=-0.320, p=0.022) is decreased. There was also a relationship between misattribution of emotional stimuli, and symptom of disorganisation. False positive anger, sad, and neutral responses were correlated with disorganised factor (r=0.332, p=0.017; r=0.365, p=0.008; r=-0.315, p=0.024, respectively). Moreover, our results indicated that higher disorganisation symptom severity related to poor determining ability of emotion acuity (r=-0.316, p=0.024).

An initial set of bivariate correlational analyses also was performed to examine whether performances on the perception of emotion were associated with thought disorder or not. According to the correlational analyses, the number of correctly identified happy and fearful faces on the PERT and the total number of correctly identified facial expressions (PERT total) were related to the thought disorganization score (r=-0.45, r=0.001; r=-0.32, p=0.020; and r=-0.38, p=0.005; respectively). The recognition of false positive happy and anger responses was found to be correlated to a more severe disorganized thought disorder (r=0.49, p=0.001; r=0.36, p=0.013; respectively). Among emotion recognition variables, only the

Table 2. Emotion recognition variables: patients vs. controls

Measure	Patients (N=53) Mean (SD)	Controls (N=38) Mean (SD)	Z-value	P-value
PERT total	28.42 (6.69)	34.23 (3.02)	-4.72	<0.01
PERT happy response	7.54 (1.10)	7.92 (0.27)	-1.96	0.04
PERT sad response	5.89 (1.78)	7,36 (0.85)	-4.33	<0.01
PERT fear response	5.33 (2.14)	6.58 (1.42)	-2.68	<0.01
PERT anger response	4.40 (1.82)	5.58 (1.26)	-3.12	<0.01
PERT neutral response	5.30 (2.62)	6.79 (0.85)	-2.5	<0.01
PERT FP happy response	1.75 (3.13)	0.63 (0.91)	-2.07	0.04
PERT FP sad response	3.90 (3.28)	2.23 (1.30)	-1.90	0.06
PERT FP fear response	1.60 (1.33)	.63 (1.07)	-3.83	<0.01
PERT FP anger response	.98 (1.41)	.42 (.91)	-1.96	0.03
PERT FP neutral response	3.33(3.28)	1.84 (1.74)	-2.74	<0.01
PEDT total	16.92 (6.05)	22.15 (5.63)	-3.94	<0.01
PEAT effciency	4.12 (0.91)	4.73 (.45)	-4.34	<0.01

PERT, Penn Emotion Recognition Test; PEDT, Penn Emotion Discrimination Test; PEAT, Penn Emotion Acuity Test; FP, False Positive.
*Statistical significance p<0.05

number of falsely identified sad faces was associated with impoverishment of thought (r=0.28, p=0.042). While none of the emotion discrimination variables on the PEAD were found to be related to thought disorder, emotion acuity efficiency score on the PEAT was correlated to both TLI disorganization score (r=-0.34, p=0.017), and TLI impoverishment score (r=-0.27, p=0.045). Although correlations between impoverishment of thought and the perception of emotion variables lost their significance after applying the Bonferroni correction, correct recognition of happiness, false positive recognition of happiness, and total emotion recognition score remained significant which indicate difficulties on identification of positive emotions strongly associated with disorganised thought.

DISCUSSION

Consistent with the previous qualitative reviews (1, 27), patients with schizophrenia performed more poorly than the control subjects on facial emotion perception tests. Our results showed that there was a significant difference between patients and healthy subjects in terms of the recognition of negative, positive, and neutral emotional stimuli. In our study, there was no difference in the recognition of happy faces between patients and healthy controls; however, the patients failed to identify negative emotional expressions as compared to the controls possibly because patients with schizophrenia have a lower ability to recognise negative emotional expressions compared to the positive ones (6). In addition, patients with schizophrenia tended to misattribute the negative emotions to neutral stimuli, which is consistent with earlier reports (8, 12).

A few studies have investigated the relationship between emotion-specific deficits and the presentation of schizophrenia symptoms in different domains. Previous reports showed that while negative emotion recognition difficulties such as misrecognition of fearful faces is correlated to negative symptoms (1, 4), misattribution of emotions, especially emotions misinterpreted as negative emotions linked to positive symptoms and disorganisation (12). Consistent with previous results, our findings indicated that negative symptoms severity has an inverse relation with recognition of fear. This result suggested that sensitiveness to negative stimuli may have an effect on negative symptoms like social withdrawal and depression, or vice versa. On the other hand, disorganised symptoms domain was found to be correlated with misidentification of fearful and neutral faces, as well as misattribution of anger and sadness. Patients with disorganised symptoms might have a tendency to report stimuli as sad or anger however the emotion was not sadness or anger possibly due to reality distortion (12).

Although we failed to find a link between disorganized thought and the discrimination of facial emotions which is mainly related to visual perception and spatial analysis (2), our findings indicate that the recognition of facial emotions and the acuity in determining emotions were correlated with disorganized thought, and this was consistent with earlier reports linking social cognition to thought disorders (16, 19, 21). A difficulty in understanding with regard to what is socially or emotionally appropriate in a situation could be related to thought disorder (15). Subotnik et al. (16) have reported that impairments to social cue recognition are associated with formal thought disorders. The misidentification of social cues such as internal and external emotional or mental states that cause a lack of awareness of the perspective of self and others' may have negative effects on speech, and thought disorders in schizophrenia (19). Moreover, neuro-scientific reports have noted that activation of the (posterior) temporal cortex and temporo-parietal occipital junction (TPJ) correlated social cognitive impairments as well as symptoms of schizophrenia such as thought disorders. The abnormal over-activation of the TPJ that might be subservient to social brain affects disorganization, and other syndromes of schizophrenia (28).

Our findings also indicated that defects in the misattribution of facial emotional expressions correlated with disorganised thought, and most importantly, the identification of a happy emotion in a face when the emotion was not happiness was indeed had strong correlation with disorganized thought. Unlike the identification of negative emotions, which is related to automatic detection and analysis of threating factors, recognition of happiness depends on a serial and linear analysis. Although studies showed that patients with schizophrenia recognise positive emotions better than negative emotions, impairment in serial and linear analysis of positive emotions may contribute to disorganized thought processing (29). In other words, the inability to adequately represent another person's mental or emotional state, which disrupts the integration of contextual information with internal emotional representation, could cause bizarre speech, derailment, and distractibility (21, 22); and inevitably withdrawal from social relationships, and impairment in psychosocial functioning (10). In addition to this, patients who are less capable of recognizing positive emotion stimuli could have a more negative view of external world, and this situation may reflect to formation of disorganisation (30).

Concerning rehabilitation programs involving patients with schizophrenia, the processing of disturbances in facial emotion was linked to a greater supervision in living status, and poorer occupational status (31). Moreover, a recent study (32) have suggested that pressured and disorganized speech and thought seemed to affect the quality of life, while impoverished speech was a predictive factor for real life functioning, and social relationships with others. In that respect, social cognitive interventions which are focused on emotional perception and other social cognition domains (e.g. ToM and social perception) may improve the patients' psychosocial functioning and interpersonal communication (33) while ameliorating disorganized, bizarre, and pressured thoughts. Intervention aimed to improve the ability of identification of emotional and mental states may lead to slower, facilitated, unpressured, and organised thought processing, and also to better social relationships and daily functioning in patients with schizophrenia.

There were some limitations to the current study. First, previous studies of conceptual models related neurocognitive functions to emotion perception, and they found neurocognition to be a mediator between social cognition and psychosocial functioning (18, 34). Moreover, these studies suggested that neurocognitive functions such as semantic processing, and executive function are related to thought disorder (31). Thus limitations of the present study include the absence of measures of neurocognitive functions and psychosocial functioning in order to determine the influence of these measures on the perception of emotion and thought disorders. Secondly, in our study we included only tests of emotion perception as the social cognitive variable; however, several studies have indicated that formal thought disorder is related to the theory of mind, attributional bias, and social cue recognition (16, 22). Thirdly, we compared the test performance of patients to healthy controls. Larger samples and comparison groups including other psychiatric disorders may contribute substantially to the replication of the relationship between the perception of emotion, and formal thought disorder in schizophrenia.

Ethics Committee Approval: Certification was received from the Local Ethics Committee of the Dokuz Eylül University, Turkey.

Informed Consent: Written informed consent form was obtained from all patients.

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