

## Social Cognition in Schizophrenia Patients and Their First-Degree Relatives

Rukiye AY<sup>1</sup>, Ömer BÖKE<sup>1</sup>, Ozan PAZVANTOĞLU<sup>2</sup>, Ahmet Rifat ŞAHİN<sup>1</sup>, Gökhan SARISOY<sup>1</sup>, Ali Cezmi ARIK<sup>1</sup>, Hatice GÜZ<sup>1</sup>

<sup>1</sup>Department of Psychiatry, Ondokuz Mayıs University School of Medicine, Samsun, Turkey

<sup>2</sup>Department of Psychiatry, Sokrates Psychiatry Center, İzmir, Turkey

### ABSTRACT

**Introduction:** Social cognition is a person's ability to configure the designs of relationships between themselves and others and to use these designs to guide social behaviors in a flexible manner. The models that are the most studied and describe social cognition are the theory of mind (ToM) and emotion recognition. This study was aimed to detect ToM and emotion recognition disorders in schizophrenia patients and their first-degree relatives.

**Methods:** Thirty schizophrenia patients in remission, the first-degree relatives of schizophrenia patients (n=30), and 30 healthy volunteers who were paired with the patients in terms of age and duration of education were included in the study. The Positive and Negative Symptom Scale (PANSS), Dokuz-Eylül Theory of Mind Scale (DEToMS), Reading the Mind in the Eyes test, Facial Emotion Identification Test (FEIT), and Facial Emotion Discrimination Test (FEDT) were performed by the patients participating in this study.

**Results:** ToM and emotion recognition were found to be defective in the schizophrenia patients and their relatives. The performances of

ToM and emotion recognition were ranked as the schizophrenia group, family group, and control group, from the worst to the best. The schizophrenia group showed poor performance in all sub-components except irony. In the family group, the empathy subcomponent showed similar performance with the control group, whereas the subcomponents of the second-order false belief, metaphor, and faux pas tests showed similar performance with the patient group. There were differences among the three groups in the first-order false belief subscale as well as the total DEToMS. The patient and family groups showed the poorest performances, whereas the control group showed the best performance.

**Conclusion:** The detection of ToM and emotion recognition disorders in the remission period, regardless of the attack period and asymptomatic first-degree relatives, may support the view that the period of schizophrenia is an independent continuous variable.

**Keywords:** Schizophrenia, theory of mind, emotion recognition

### INTRODUCTION

Social cognition is defined as a person's ability to configure the designs of relationships between themselves and others and to use these designs to guide social behaviors (1). Problems in this area can affect work/school behaviors as well as familial and romantic relationships. Social cognition also affects functioning in terms of independent life skills. Social cues from the environment are also necessary in order to properly assess social opportunities and to learn skills such as home and financial resource management (2,3).

Social cognition consists of subheadings such as social information, social perception, affective closeness, and theory of mind (ToM) (4). The models that are the most studied and that describe social cognition are ToM and emotion recognition. Emotion recognition is the interpretation of emotional information obtained from facial expressions, tone of voice, or both and the emotional processing and use of such information (4). ToM is the ability to realize that another person's mental state differs from one's own and to make correct deductions about the content of others' mental states (such as intention and belief) (5).

Frith (6) compared autism and schizophrenia and suggested that the compromise of social interaction and communication was similar in both. Studies have shown emotion recognition impairment in schizophrenia patients (7,8,9).

Some studies have reported significantly greater ToM impairment in the relatives of schizophrenia patients than controls (10,11,12,13). Other studies, however, have determined no ToM impairment in the relatives of schizophrenia patients (14,15). Similarly, while some studies have determined emotion recognition deficits in the relatives of schizophrenia patients (16,17), others have observed no such deficits (18,19).

The purpose of this study was to determine the probable impairment of cognitive functions in schizophrenia patients and their first-degree relatives. The study hypothesis was that groups comprising schizophrenia patients, their first-degree relatives, and healthy controls would



**Correspondence Address:** Rukiye Ay, Ondokuz Mayıs Üniversitesi Tıp Fakültesi, Psikiyatri Anabilim Dalı, Samsun, Türkiye  
E-mail: rukiyeay@gmail.com

Received: 10.02.2015 Accepted: 27.08.2015

©Copyright 2016 by Turkish Association of Neuropsychiatry - Available online at www.noropsikiyatriarsivi.com

differ in terms of ToM and emotion recognition performances and that performances would be the poorest in schizophrenia patients, better in first-degree relatives, and the best in healthy controls.

## METHODS

Thirty patients presenting to the Ondokuz Mayıs University School of Medicine Department of Psychiatry between April and September, 2014, diagnosed with schizophrenia on the basis of DSM IV-TR (20) criteria, and still receiving treatment and monitoring, first-degree relatives of schizophrenia patients (30), and 30 healthy volunteers matched with schizophrenia patients in terms of age and length of education were included in the study. Informed consent was taken from each of the three groups. Approval for the research project was granted by the Ondokuz Mayıs University Medical faculty ethical committee. As the validity and reliability of Turkish-language tests measuring affective closeness, social perception, and social information in social cognition had not been established, these were not used. ToM and emotion recognition tests, whose Turkish-language validity and reliability had been established, were used.

Those schizophrenia patients under monitoring who were primary school graduates, aged 18–55 years and meeting remission criteria (each item in PANSS being  $\leq 3$  in the previous 6 months), were enrolled. Patients with severe physical or neurological disease, with alcohol or substance-abuse disorders, or undergoing electroconvulsive therapy in the previous 6 months were excluded (patient group).

First-degree relatives, aged 18–55 years and with at least primary education, of the patients in the schizophrenia group were included in the study. Relatives with any psychiatric disorders, severe physical or neurological diseases, or with a history of drug use that might affect cognitive functions in the previous month were excluded (family group).

Healthy volunteers matched with the schizophrenia patients in terms of age and length of education were enrolled as the control group. Patients with no psychiatric disorders, no severe physical or neurological diseases, and no history of drug use that might affect cognitive functions in the previous month were included in the control group. The control group was made up of hospital personnel and relatives of the authors (control group).

### Positive and Negative Symptom Scale (PANSS)

PANSS was developed by Kay et al. (21) It investigates schizophrenia and other psychotic disorders. This semi-structured scale is administered by the interviewer, assesses positive and negative symptoms and general psychopathology in psychosis patients, and measures the level of those symptoms. The Turkish-language version was validated by Kostakoğlu et al. (22)

### Dokuz-Eylül Theory of Mind Scale (DEToMS)

DEToMS was developed by Değirmenciöğlü (23) for the purpose of investigating ToM abilities. The scale consists of four questions measuring first-order false belief (FOFB), three investigating second-order false belief (SOFB), three measuring irony, two measuring metaphor, and one measuring faux pas. In addition to ToM abilities, five questions requiring empathic understanding in both story and image tasks were added to the scale. The inventory consists of a total of 18 questions containing three pictures and seven story tasks. As a number of ToM abilities, such as physical realism, ranking, and attention, were not required, six control questions were included: two image and four story. If the subject was unable to correctly answer all the control questions, the inventory was regarded as invalid.

### Reading the Mind in the Eyes Test

This test was first published by Baron-Cohen et al. (24) in 1997 in the form of 25 questions. The revised version published in 2001 consists of 36 questions with four possible answers (25). The subject is asked to choose which option best describes the mental state of the individual in the picture. The options inquire into complex emotions and intentions. The test is, therefore, regarded as a marker of emotion recognition and ToM ability. The validity and reliability of the Turkish-language version were investigated by Yıldırım et al. (26) The Turkish-language form consisted of 32 items. One point is awarded for each correct score. Possible scores range from 0 to 32.

### Facial Emotion Identification Test (FEIT)

Based on well-known black and white photographs by Ekman and Friesen (27), the test was developed by Kerr and Neale (28). It consists of a slide show containing 19 black and white photographs of faces showing various expressions of emotion. The photographs contain six main emotions (joy, sorrow, anger, disgust, fear, and surprise). The subject is given a 19-item response key in which the six emotions are listed for each question. The subject is asked to mark which emotion best matches each photograph. One point is given for each correct answer and 0 for incorrect answers. The maximum possible score is 19. Validity and reliability of the Turkish-language version were investigated by Erol et al. (29)

### Facial Emotion Discrimination Test (FEDT)

The FEDT was developed by Kerr and Neale (28) in 1993. It consists of 30 black and white photographs containing six main emotions (joy, sorrow, anger, disgust, fear, and surprise). The subject is asked to determine whether the emotion expressed in the two faces is the same or different for each photograph. The options "same" and "different" are written under each question. The subject indicates whether each pair of photographs are the same or different. One point is awarded to a correct answer and 0 for an incorrect answer. The highest possible score is 30. The validity and reliability of the test in Turkish society was investigated by Erol et al. (29) in 2009.

### Measurement, Assessment, and Statistical Analysis

Data from the study groups were analyzed on the "Statistical Package for the Social Sciences for Windows 15.0" (SPSS Inc.; Chicago, IL, USA) software. Data obtained by counting were expressed as percentages and those obtained by measurement as mean plus standard deviation.

The chi square test was used to compare categorical variables. One-way ANOVA, a parametric test, in the comparison of groups' numerical variables and Tukey's HSD test for two-way comparison of groups between which differences exist were determined. Significance was set at 0.95 ( $<0.05$ ) for all analyses.

## RESULTS

Sex, age, and education levels for all groups in the study are shown in Table 1. Mean duration of disease in the patient group was  $127.93 \pm 96.09$  months, age at onset of disease  $22.33 \pm 6.73$  years, and length of time before treatment  $13.5 \pm 18.80$  months. Mean number of episodes was  $2.96 \pm 2.53$ . Patients' mean positive PANSS score was  $10.13 \pm 3.50$ , mean negative PANSS score  $13.93 \pm 2.87$ , mean PANSS general symptomatology score  $25.93 \pm 5.16$ , and mean total PANSS score  $50.33 \pm 9.27$ . Three patients were using multiple antipsychotics. The 30 patients used 33 antipsychotics (three patients were using dual combined antipsychotics) at a dose equivalent to mean  $237.90 \pm 163.46$  mg/day chlorpromazine. Three patients were using mood regulators in addition to antipsychotic therapy and four were using antidepressants in addition to antipsychotic therapy.

**Table 1.** Group sociodemographic characteristics

		Patient (n=30)	Family (n=30)	Control (n=30)	Analysis	p
Sex	Female n (%)	15 (50%)	21 (70%)	12 (40%)	X <sup>2</sup> =5.625	0.600
	Male n (%)	15 (50%)	9 (30%)	18 (60%)		
Age (years)	Mean±SD	33±9.97	42.4±14.1	33.13±9.76	F=0.501	0.851
Education (years)	Mean±SD	12.1±4.02	9.4±4.36	11.7±3.80	F=0.103	1.00

Chi-square test and One-Way ANOVA. SD: standard deviation

**Table 2.** Comparison of the groups' DEToMS and Eyes Test scores

	Patient (n=30) Mean±SD	Family (n=30) Mean±SD	Control (n=30) Mean±SD	F	p
FOFB	3.0±0.94	3.46±0.628	3.90±0.305	13.164	<0.0001
SOFB	1.20±0.92	1.70±0.87	2.33±0.66	14.088	<0.0001
Irony	1.66±1.09	1.96±0.92	2.20±1.09	1.976	0.145
Metaphor	1.13±0.68	1.20±0.76	1.66±0.54	5.661	0.005
Empathy	4.20±0.88	4.70±0.59	4.76±0.43	6.509	0.02
Faux pas	0.13±0.34	0.03±0.18	0.40±0.49	8.069	0.001
Total DEToMS	11.33±2.30	13.06±2.04	15.3±1.70	28.604	<0.0001
Eyes Test	17.73±4.42	20.86±3.77	24.2±2.51	23.446	<0.0001

One-Way ANOVA. FOFB: First-order false belief; SOFB: second-order first belief; DEToMS: Dokuz-Eylül Theory of Mind Scale

**DEToMS and the Eyes Test**

FOFB score, total DEToMS score, and Eyes Test score differed significantly between the groups. In a two-way comparison, the patient group exhibited the poorest performance, followed by the family group. The control group exhibited the best performance. SOFB, metaphor, and faux pas scores differed significantly between the groups. In a two-way comparison, the control group exhibited a better performance than both the patient and family groups. Empathy scores also differed significantly (Table 2). In a two-way comparison, the patient group exhibited the worse performance than the other two groups (Table 3). Irony scores did not differ significantly between the groups.

**FEIT and FEDT**

Statistically significant variation was determined in the FEIT and FEDT tests (Table 4). In a two-way comparison, the patient group exhibited the worst performance, followed by the family group, and the control group gave the best performance (Table 5).

**DISCUSSION**

This study identified ToM defects in schizophrenia patients and their first-degree relatives. The defect in schizophrenia patients was significantly higher than that in the families.

DEToMS and the Eyes Test were used for ToM measurement in this study. The patient group exhibited the worst performance in both tests, followed by the family group, and the control group gave the best performance. Compromise in both tests was assessed as ToM defects in this section.

Previous studies have shown ToM impairment in schizophrenia patients (30,31,32). While some studies have interpreted ToM compromise as

**Table 3.** Two-way comparison of DEToMS and Eyes Test scores

	Patient x Control, p	Family x Patient, p	Control x Family, p
FOFB	0.000	0.025	0.041
SOFB	0.000	0.056	0.011
Metaphor	0.008	0.921	0.022
Empathy	0.004	0.013	0.920
Faux pas	0.016	0.542	0.001
Total DEToMS	0.000	0.004	<0.0001
Eyes test	0.000	0.004	0.002

Tukey's HDS. FOFB: first-order false belief; SOFB: second-order first belief; DEToMS: Dokuz-Eylül Theory of Mind Scale

**Table 4.** Comparison of FEIT and FEDT test scores by groups

	Patient (n=30) Mean±SD	Family (n=30) Mean±SD	Control (n=30) Mean±SD	F	p
FEIT	10.66±2.46	12.56±1.99	14.2±1.88	20.671	<0.0001
FEDT	23.40±2.41	24.96±2.55	26.53±1.52	15.051	<0.0001

One-Way ANOVA. FEIT: Facial Emotion Identification Test; FEDT: Facial Emotion Discrimination Test; SD: standard deviation

**Table 5.** Two-way comparison of FEIT and FEDT test scores

	Patient x Control, p	Patient x Family, p	Control x Family, p
FEIT	<0.0001	0.002	0.011
FEDT	<0.0001	0.020	0.020

Tukey's HDS. FEIT: Facial Emotion Identification Test; FEDT: Facial Emotion Discrimination Test

a situational marker associated with symptoms in the attack phase of the disease only (33,34,35); others, the majority, have reported ToM defect as a constant marker in both the active phase and in remission (10,36,37,38,39,40,41). We determined ToM disorders in schizophrenia patients in the remission period in this study. Our results were in agreement with the literature, to the effect that ToM disorder is an independent variable in the attack period and a constant variable in remission.

Some studies have determined significantly greater ToM defects in the relatives of schizophrenia patients compared to controls (10,11,12,13). In contrast to our research, two previous studies observed no ToM disorder in families. The first study included 79 relatives of schizophrenia patients and determined no disorder in relatives using the Eyes Test. Measurements in cartoon or story tests are correlated with attention and working memory, as well as ToM skills. It is impossible to ascribe all failures in these tests to ToM. The Eyes Test, on the other hand, requires spontaneous judgment. In that study, ToM was measured independently of other cognitive functions and no impairment was determined in patients' relatives, and the conclusion reached was defended on the basis of these statements (14). In the second study, Cassetta and Goghari (15) used video-based ToM tests and revealed that, in contrast to schizophrenia patients, patients' relatives were no different to the controls in their true life relations.

In our study, we determined ToM defects in first-degree relatives of schizophrenia patients. In contrast to Cassetta et al. (15), we did not use a video-based real world test. Our findings are compatible with those of studies suggesting that ToM defect may be a variable also seen in family members and associated with a disposition to schizophrenia, rather than being a sequel of the disease in schizophrenia (10,42). In our study, too, the fact that ToM defects were present in both relatives and in schizophrenia patients in remission, suggests they may constitute a potential endophenotype. It has been suggested that the use of different tools in the methodology, such as written, cartoon, or video-based ToM tests; the differing ages of the relatives and patients included; and the failure to enroll a control group, matched separately for these two groups in terms of confusing factors such as age, sex, and education, and may have led to different results being obtained in previous studies (43). However, it should not be forgotten that ToM defects determined in families may derive from sub-syndromal symptoms and schizotypal features in families. Diseases that may appear in families in the future must also not be excluded (44).

DEToMS subscales measure ToM components. There was a difference between all three groups in the FOFB subcomponent and total DEToMS. The patient group exhibited the poorest performance, followed by the family group, and the control group exhibited the best performance. It may be that factors that cause the disease to appear, and create a disposition to it, lead to greater ToM impairment in patients than in families.

In this study, emotion recognition defect was determined in schizophrenia patients and first-degree relatives. Defect in patients was significantly greater than that in family members. In terms of recognition of emotions in the face, the ability to recognize an emotion and the ability to name it may be confused. The ability to discriminate between emotions was developed as a separate test alongside the emotions recognition test in order to overcome this problem. Erol et al. (29) recommend the use of the FEIT and FEDT together. FEIT and FEDT were used together in this study in order to measure emotion recognition. Similar results were obtained from both tests. The patient group exhibited the worst performance, followed by the family group, and the control group exhibited the best performance. Impairment in both tests will be referred to as emotion recognition defect hereafter in the discussion section.

Previous studies have shown that emotion recognition was impaired in schizophrenia patients (7,8,9). The question has also arisen of whether emotion recognition is a characteristic of schizophrenia attack or of schizophrenia independently of attack. Some studies have suggested that emotion recognition deficit in schizophrenia occurs in the attack period but not in remission (45,46), while others have suggested that emotion recognition deficits persists also in remission (16,35,47).

We identified emotion recognition defects in patients in remission in this study. As this persists in remission independently of disease status, and emotion recognition performance was worse in families of schizophrenia patients compared to the controls, our findings are compatible with the literature to the effect that emotion recognition defect is a constant variable for schizophrenia independently of the active stage of the disease.

Some studies have determined significantly greater emotion recognition deficits in patients' relatives than in controls (16,17). Other studies, however, identified no emotion recognition deficit in the family members of schizophrenia patients. Kee et al. (18) used the FEDT, vocal emotion recognition, video-based emotion recognition, and combined emotion recognition tests. The emotion recognition defect was identified only in the group using the combined test. The authors reported

that the defect in families was very low level and could only be revealed by complex tests. Eack et al. (19) determined significant emotion recognition deficits in patients' relatives but reported that these deficits were associated with prodromal symptoms. We determined emotion recognition deficits in first-degree relatives by both FEIT and FEDT. These findings were compatible with studies espousing the view that emotion recognition defects may be a variable also seen in relatives without schizophrenia and other psychiatric diseases and associated with a predisposition to schizophrenia. It is therefore possible, as other studies have emphasized, that emotion recognition is an endophenotype for schizophrenia patients (47,48,49). The fact that schizophrenia patients exhibited a worse performance than families suggests a connection between emotion recognition and disease emergence. Emotion recognition defects passing a specific threshold may cause the disease to emerge or the emergence of the disease may cause emotion recognition defects to pass a specific threshold. It has been suggested that the different results among studies derive from remission periods not being defined in a standard manner and emotion recognition being measured using different tests (47).

### Study Limitations

Participants with no clinically determined intelligence retardation were selected, without measuring intelligence levels. However, there may have been a difference in intelligence levels, and this may affect the ability to apply, understand, and give appropriate responses to the test.

Another limitation is that no scale testing neurocognition was employed. The inclusion of neurocognitive tests evaluating regions of the brain associated with social cognition skills and the assessment of the effect on social cognition might provide more reliable results.

In addition, while the patient and control groups were matched in terms of age and education level (potential confusing factors), the first-degree relatives and controls could not be matched. The establishment of a control group appropriately matched to the family group might have permitted a more accurate assessment.

Another limitation is that the participants were not administered a scale measuring alexithymia. This measurement would make it possible to evaluate subjects' emotion recognition, description, and internally oriented thinking skills using another test.

We enrolled schizophrenia patients in remission, but we did not assess patients' symptoms in the attack phase. The assessment of patients with different syndromes in the attack phase might have produced different results.

In conclusion, we determined the ToM and emotion recognition performances of schizophrenia patients in remission, first-degree relatives with no disease symptoms, and healthy controls. The patient group exhibited the worst performances, followed by the first-degree relatives and the healthy controls. The determination of ToM and emotion recognition defects in the remission phase, independent of the attack phase, and in first-degree relatives with no disease symptoms supports the idea that these are a potential endophenotype for schizophrenia.

Emotion cognition and ToM may be an endophenotype for schizophrenia, but further studies with larger numbers of subjects, in which chronic period and new attack patients are separately assessed and in which potentially confusing factors such as age, sex, and education level are excluded, are now needed.

**Ethics Committee Approval:** Ethics committee approval was received for this study from the ethics committee of Ondokuz Mayıs University School of Medicine.

**Informed Consent:** Written informed consent was obtained from patients who participated in this study.

**Peer-review:** Externally peer-reviewed.

**Author Contributions:** Concept – R.A., O.P.; Design – R.A., O.P.; Supervision – R.A., Ö.B.; Resources – R.A., Ö.B.; Materials – R.A.; Data Collection and/or Processing – R.A.; Analysis and/or Interpretation – R.A., Ö.B.; Literature Search – R.A.; Writing Manuscript – R.A., Ö.B.; Critical Review – R.A., Ö.B., A.R.Ş., G.S., A.C.A., H.G.; Other – R.A., Ö.B.

**Conflict of Interest:** No conflict of interest was declared by the authors.

**Financial Disclosure:** The authors declared that this study has received no financial support.

## REFERENCES

- Smith ER, Semin GR. Situated social cognition. *Curr Dir Psychol Sci* 2007; 16:132-135. [CrossRef]
- Couture SM, Penn DL, Roberts L. The functional significance of social cognition in schizophrenia: a review. *Schizophr Bull* 2006; 32(Suppl 1): 44-63. [CrossRef]
- Brüne M. Theory of mind in schizophrenia: a review of the literature. *Schizophr Bull* 2005; 31(Suppl 1):21-42. [CrossRef]
- Green MF, Penn DL, Bentall R, Carpenter WT, Gaebel W, Gur RC, Kring AM, Park S, Silverstein SM, Heinssen R. Social cognition in schizophrenia: a NIMH workshop on definitions, assessment, and research opportunities. *Schizophr Bull* 2008; 34:1211-1220. [CrossRef]
- Green MF, Olivier B, Crawley JN, Penn DL, Silverstein S. Social cognition in schizophrenia: recommendations from the measurement and treatment research to improve cognition in schizophrenia new approaches conference. *Schizophr Bull* 2005; 31:827-882. [CrossRef]
- Frith CD. *The cognitive neuropsychology of schizophrenia*. Hove, UK: Psychology Press. 1992.
- Kucharska-Pietura K, David AS, Masiak M, Phillips ML. Perception of facial and vocal affect by people with schizophrenia in early and late stages of illness. *Br J Psychiatry* 2005; 187:523-552. [CrossRef]
- Addington J, Saeedi H, Addington D. Facial affect recognition: a mediator between cognitive and social functioning in psychosis? *Schizophr Res* 2006; 85:142-150. [CrossRef]
- Leung JS, Lee TM, Lee CC. Facial emotion recognition in Chinese with schizophrenia at early and chronic stages of illness. *Psychiatry Res* 2011; 190:172-176. [CrossRef]
- Janssen I, Krabbendam L, Jolles J, Van Os J. Alterations in theory of mind in patients with schizophrenia and non-psychotic relatives. *Acta Psychiatr Scand* 2003; 108:110-117. [CrossRef]
- Anselmetti S, Bechi M, Bosia M, Quarticelli C, Ermoli E, Smeraldi E, Cavallaro R. Theory of mind impairment in patients affected by schizophrenia and in their parents. *Schizophr Res* 2009; 115:278-285. [CrossRef]
- Achaval D, Costanzo EY, Villarreal M, Ja'uregui IO, Chiodi A, Castro MN. Emotion processing and theory of mind in schizophrenia patients and their unaffected first-degree relatives. *Neuropsychologia* 2010; 48:1209-1215. [CrossRef]
- Montag C, Neuhaus K, Lehmann A, Krüger K, Dziobek I, Heekeren HR, Heinz A. Subtle deficits of cognitive theory of mind in unaffected first-degree relatives of schizophrenia patients. *Eur Arch Psychiatry Clin Neurosc* 2012; 262:217-226. [CrossRef]
- Kelemen O, Ke'ri S, Must A, Benedek G, Janka Z. No evidence for impaired theory of mind in unaffected first-degree relatives of schizophrenia patients. *Acta Psychiatr Scand* 2004; 110:146-149. [CrossRef]
- Cassetta B, Gohari V. Theory of mind reasoning in schizophrenia patients and non-psychotic relatives. *Psychiatry Res* 2014; 218:12-19. [CrossRef]
- Kucharska-Pietura K, David AS, Masiak M, Phillips ML. Perception of facial and vocal affect by people with schizophrenia in early and late stages of illness. *Br J Psychiatry* 2005; 187:523-552. [CrossRef]
- Erol A, Mete L, Sonmez I, Unal EK. Facial emotion recognition in patients with schizophrenia and their siblings. *Nord J Psychiatry* 2010; 64:63-67. [CrossRef]
- Kee KS, Horan WP, Mintz J, Green MF. Do the siblings of schizophrenia patients demonstrate affect perception deficits? *Schizophr Res* 2004; 67:87-94. [CrossRef]
- Eack SM, Mermon DE, Montrose DM, Miewald J, Gur RE, Gur RC, Sweeney JA, Keshavan MS. Social cognition deficits among individuals at familial high risk for schizophrenia. *Schizophr Bull* 2010; 36:1081-1088. [CrossRef]
- Amerikan Psikiyatri Birliđi: Ruhsal Bozuklukların Tanısal ve Sayımsal El Kitabı, Dördüncü Baskı Yeniden Gözden Geçirilmiş Tam Metin (DSM-IV-TR), Körođlu E (Çeviri Ed.) 4. Baskı, Ankara: Hekimler Yayın Birliđi, 2007; 419-447.
- Kay SR, Fiszbein A, Opler LA. The positive and negative syndrome scale (PANSS) for schizophrenia. *Schizophr Bull* 1987; 13:261-276. [CrossRef]
- Kostakođlu AE, Batur S, Tiryaki A, Göğüş A. Pozitif ve Negatif Sendrom Ölçeđinin (PANSS) Türkçe uyarlamasının geçerlilik ve güvenilirliđi. *Türk Psikoloji Dergisi* 1999; 14:23-32.
- Değirmenciođlu B. İlk kez geliştirilecek olan Dokuz Eylül Zihin Teorisi Ölçeđinin (DEZTÖ) geçerlik ve güvenilirlik çalışması. Yüksek Lisans Tezi, Dokuz Eylül Üniversitesi Sağlık Bilimleri Enstitüsü Sınır Bilimler Anabilim Dalı, İzmir, 2008.
- Baron-Cohen S, Jolliffe T, Mortimore C, Robertson M. Another advanced test of theory of mind: evidence from very high functioning adults with autism or Asperger syndrome. *J Child Psychiatry* 1997; 38:813-822. [CrossRef]
- Baron-Cohen S, Wheelwright S, Hill J, Raste Y, Plumb I. The "Reading the Mind in the Eyes" Test revised version: a study with normal adults, and adults with Asperger syndrome or high-functioning autism. *J Child Psychol Psychiatry* 2001; 42:241-251. [CrossRef]
- Yıldırım EA, Kasar M, Guduk M. Gözlerden Zihin Okuma Testi'nin Türkçe Güvenirlik Çalışması. *Türk Psikiyatri Dergisi* 2011; 22:177-186.
- Ekman P, Friesen WV. *Pictures of facial affect*. Palo Alto, Consulting Psychologists Press, 1976.
- Kerr SL, Neale JM. Emotion perception in schizophrenia: Specific deficit or further evidence of generalized poor performance? *J Abnorm Psychol* 1993; 102:312-318. [CrossRef]
- Erol A, Ünal Keleş E, Gülpek D, Mete L. Yüzde dışarı vuran duyguların tanınması ve ayrıtılması testlerinin Türk toplumunda güvenilirlik ve geçerlilik çalışması. *Anadolu Psikiyatri Dergisi* 2009; 10:116-123.
- Mazza M, De Risio A, Surian L, Roncone R, Casacchia M. Selective impairments of theory of mind in people with schizophrenia. *Schizophr Res* 2001; 47:299-308. [CrossRef]
- Bora E, Eryavuz A, Kayahan B, Sungu G, Veznedaroglu B. Social functioning, theory of mind and neurocognition in outpatients with schizophrenia; mental state decoding may be a better predictor of social functioning than mental state reasoning. *Psychiatry Res* 2006; 145:95-103. [CrossRef]
- Bozıkas VP, Giannakou M, Kosmidis MH, Kargopoulos P, Kioseoglou G, Liolios D, Garyfallos G. Insights into theory of mind in schizophrenia: the impact of cognitive impairment. *Schizophr Res* 2011; 130:130-136. [CrossRef]
- Harrington L, Siegert RJ, McClure J. Theory of mind in schizophrenia: a critical review. *Cogn Neuropsychiatry* 2005; 10:249-286. [CrossRef]
- Pousa E, Du-ó R., Brébio G, David AS, Ruiz AI, Obiols JE. Theory of mind deficits in chronic schizophrenia: Evidence for state dependence. *Psychiatry Res* 2008; 158:1-10. [CrossRef]
- Balogh N, Égerházi A, Berecz R, Csukly G. Investigating the state-like and trait-like characters of social cognition in schizophrenia: A short term follow-up study. *Schizophr Res* 2014; 159:499-505. [CrossRef]
- Herold R, Tényi T, Lénárd K, Trixler M. Theory of mind deficit in people with schizophrenia during remission. *Psychol Med* 2002; 32:1125-1129. [CrossRef]
- Kelemen O, Erdelyi R, Pataki I, Benedek G, Janka Z, Keri S. Theory of mind and motion perception in schizophrenia. *Neuropsychology* 2005; 19:494-500. [CrossRef]
- Marjoram D, Gardner C, Burns J, Miller P, Lawrie SM, Johnstone EC. Symptomatology and social inference: a theory of mind study of schizophrenia and psychotic affective disorder. *Cogn Neuropsychiatry* 2005; 10:347-359. [CrossRef]

39. Inoue Y, Yamada K, Hirano M, Shinohara M, Tamaoki T, Iguchi H, Tonooka Y, Kanba S. Impairment of theory of mind in patients in remission following first episode of schizophrenia. *Eur Arch Psychiatry Clin Neurosci* 2006; 256:326-328. [\[CrossRef\]](#)
40. Sprong M, Schothorst P, Vos E, Hox J, Van EH. Theory of mind in schizophrenia: Meta-analysis. *Br J Psychiatry* 2007; 191:5-13. [\[CrossRef\]](#)
41. Koelkebeck K, Pedersen A, Suslow T, Kueppers KAA, Arolt V, Ohrmann, P. Theory of Mind in first-episode schizophrenia patients: correlations with cognition and personality traits. *Schizophr Res* 2010; 119:115-123. [\[CrossRef\]](#)
42. Irani F, Platek SM, Panyavin IS, Calkins ME, Kohler C, Siegel SJ, Schachter M, Gur RE, Gur RC Self-face recognition and theory of mind in patients with schizophrenia and first-degree relatives. *Schizophr Res* 2006; 88:151-160. [\[CrossRef\]](#)
43. Lavoie MA, Bédard LJ, Godmaire-Duhaime F, Jackson PL, Achim AM. Social cognition in first-degree relatives of people with schizophrenia: a meta-analysis. *Psychiatry Res* 2013; 209:129-135. [\[CrossRef\]](#)
44. Bora E, Pantelis C. Theory of mind impairments in first-episode psychosis, individuals at ultra-high risk for psychosis and in first-degree relatives of schizophrenia: Systematic review and meta-analysis. *Schizophr Res* 2013; 144:31-36. [\[CrossRef\]](#)
45. Penn DL, Sanna LJ, Robert DL. Social cognition in schizophrenia: an overview. *Schizophr Bull* 2008; 34:408-411. [\[CrossRef\]](#)
46. Rodriguez Sosa JT, Acosta Ojeda M, Rodriguez Del Rosario L. Theory of mind, facial recognition and emotional processing in schizophrenia. *Rev Psiquiatr Salud Ment* 2011; 4:28-37. [\[CrossRef\]](#)
47. Mehta UM, Thirthalli J, Naveen Kumar C, Keshav Kumar J, Keshavan MS, Gangadhar BN. Schizophrenia patients experience substantial social cognition deficits across multiple domains in remission. *Asian J Psychiatr* 2013; 6:324-329. [\[CrossRef\]](#)
48. Kohler CG, Walker JB, Martin EA, Healey KM, Moberg PJ. Facial emotion perception in schizophrenia: a meta-analytic review. *Schizophr Bull* 2010; 36:1009-1019. [\[CrossRef\]](#)
49. Saracco- Alvarez R, Fresan A, Escamilla-Orozco R. Facial emotion recognition in schizophrenia: a comparison with siblings and control subjects. *Schizophr Res* 2013; 151:291-292. [\[CrossRef\]](#)