

# Eyes Test Performance Among Unaffected Mothers of Patients with Schizophrenia



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## SUMMARY

**Objective:** Theory of Mind (ToM) deficit is a widely accepted feature of schizophrenia. A number of studies have examined ToM deficits of first-degree relatives of schizophrenic patients as genetic markers of schizophrenia. Examination of mentalization capacity among mothers of schizophrenia patients may improve our understanding of theory of mind impairments in schizophrenia. The aim of this study is to use Reading Mind in the Eyes test to examine theory of mind capacity among mothers of schizophrenic patients.

**Method:** Performance during the test “Reading the Mind in the Eyes” (Eyes Test) was compared between the mothers of schizophrenic patients (n=47) and mothers whose children have no psychotic mental illness (n=47). Test results were analyzed based on the categorization of test items as positive, negative, and neutral.

**Results:** Mothers of schizophrenic patients displayed poorer performance during the Eyes Test compare to mothers in the control group, particularly in the recognition of positive and neutral mental representations. There was no statistically significant difference in the recognition of negative mental representations between mothers of patients and the control groups.

**Conclusion:** The results of this study indicate that mothers of schizophrenic patients differ in some theory of mind patterns. Theory of mind may be an important developmental or endophenotypic factor in the pathogenesis of schizophrenia and should be further evaluated using other biological markers.

**Keywords:** Schizophrenia, mothers, theory of mind, mentalization, Eyes Test

## INTRODUCTION

“Theory of mind” (ToM) is defined as the capacity of to make inferences regarding the emotions, thoughts, and intentions of others. Premack and Woodruff first coined this term in 1978 based on their observations in chimpanzees (Harrington 2005). Theory of mind is also an important component of the field of developmental psychology and the study of the development of cognitive processes in children. Theory of mind is considered an important feature for ensuring adaptation to the external environment (Brune 2005). Identification of endophenotypes for schizophrenia, a multigenic disease,

may inform diagnosis and classification of illness as well and provide novel insights in efforts to identify the genetic basis of schizophrenia (Özer et al. 2004, 2005, Ulaş et al. 2008). Studies of schizophrenia patients and their first-degree relatives have indicated that theory of mind pathologies may be associated with psychosis risk. Theory of mind pathologies may reveal novel targets for genetic studies of schizophrenia (Bora 2013).

Theory of mind was first applied to clinical practice children with autistic spectrum disorders (Baron-Cohen 1985) and has since been applied to the study of frontal lob lesions

Received: 23.03.2013 - Accepted: 16.03.2014

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doi: 10.5080/u7460

and schizophrenia. Recent studies involving theory of mind have included such disorders as frontotemporal dementia, Alzheimer dementia, antisocial personality disorder, bipolar mood disorder (Brüne 2008), and obsessive-compulsive disorder (Sayın, Oral et al. 2010, Grisham, Henry et al. 2010). The first study to examine theory of mind in schizophrenia was conducted by Frith; Frith claimed that autism and schizophrenia share certain similarities in impairments to social interaction (Harrington 2005).

Frith examined the role of theory of mind deficits in psychotic experiences including hallucinations and delusions and has proposed three major groups of schizophrenic symptoms: disorders of willed action (apathy and bizarre behavior), disorders of self-monitoring, and disorders in monitoring thoughts and intentions of others. All of these symptoms could be attributed to deficient theory of mind processes (Brüne 2005, Harrington 2005).

Numerous studies examining theory of mind pathologies in schizophrenia have attempted to determine whether theory of mind deficits are product of acute state of illness or permanent in nature (Harrington et al. 2005, Sayın and Candansayar 2008, Bora 2009). Additional studies examined 1) schizophrenia patients in the acute phase and in remission, 2) groups having high genetic or clinical risk for developing schizophrenia and 3) first-degree relatives of schizophrenia patients. The conclusion reached by such studies suggests that theory of mind deficits are permanent and structural in nature (Bora and Pantelis 2013).

“Mentalization”, a concept closely related to the theory of mind, is defined as the capacity to explain the mental perspectives of others and of one’s self and to predict behaviors. Fonagy (1991, 1996) was influenced by the theory of mind literature when defining the concept of mentalization. Used interchangeably from time to time, these two concepts approach the same phenomena from different perspectives; the theory of the mind primarily refers to cognitive process, while mentalization also includes affective processes (Choi-Kain and Gunderson 2008). Furthermore the concept of mentalization is widely considered one of the important components of parental responsiveness. The role of the parent is critical to the development of mental representations in the child (Fonagy 1996). The primary caregiver, often the mother, a critical role in development of the mentalization capacity of the child (Dunn 1991, Ruffman 2002).

First and second order false belief and implication comprehension tasks are widely used in theory of mind studies. However, in addition to theory of mind skills, these tasks, also reveal aspects of attention, working memory, semantic and visual-spatial processes; it may not be possible to attribute all aspects of the task results to theory of mind skills (Kelemen et al. 2005). Baron-Cohen et al. (1997) have developed the “Reading the Mind in the Eyes Test” (Eyes Test), a

test requiring inference of the mental state of a person based on facial expressions. This test depends on the ability to automatically decode non-verbal communication. (Bora et al. 2009).

First-degree relatives of schizophrenia patients have been previously examined in previous studies on theory of mind in schizophrenia patients. Considering the studies evaluating theory of mind as the endophenotype and the mentalization capacity of the primary care giver as an environmental-developmental factor a research into the theory of mind skills and pathologies among mothers of schizophrenia patients may reveal new insights into schizophrenia pathogenesis. Theory of mind function may differ among the mothers of schizophrenia patients relative to women. In the present study, we compared emotion recognition capacity from facial information among mothers of patients diagnosed as schizophrenic and mothers whose children do not have any psychotic illness. The Turkish version of the Reading the Mind in the Eyes Test was used. Eyes Test was preferred because it measures automatic mentalization and is less influenced by other cognitive skills.

## METHOD

### Target Population and Sample

The experimental group consisted of 43 mothers of inpatient and outpatient schizophrenia (DSM-4 TR) patients in the psychiatry polyclinic of Bakırköy Prof. Dr. Mazhar Osman Mental Health and Neurological Disorders Training and Research Hospital (BRSHH) with no prior history of psychotic disorder and no significant mental health history with the exception of anxiety or depressive disorder. The control group consisted of women who were of similar age and education level and who had children. Use of antidepressants due to anxiety and depressive disorders was not a criterion for exclusion from the study as being the mother of a schizophrenic patient is a significant source of stress. Subjects currently satisfying anxiety or depression diagnosis criteria were excluded and only individuals in remission were included in the study group. A total of 47 control subjects were selected from among female hospital employees with a child at least 25 years of age with no diagnosis of mood disorder or psychotic disorder and with no psychiatric diagnosis other than use of antidepressants for anxiety or depressive disorders. Mothers of patients were informed that participation in the study would have no effect on the treatment of their children. The children with schizophrenia diagnoses consisted of 14 women and 29 men. All study participants were required to possess sufficient literacy skills to understand the study materials. Individuals with head trauma, epilepsy, history of cranial operations, and persons with a history of bipolar disorder and mothers over the age of 65 were excluded. Mothers with

adequate working and visual function and without clinical mental retardation were included in the study. Informed consent was provided by all research participants. The BRSHH Ethics Committee reviewed and approved the study.

## Clinical Assessment Tools

### Socio-demographic Information Form

A socio-demographic data form was developed by the authors and included data regarding education level, age, number of children and their ages, mental disorders etc. and was completed by the researchers during the clinical pre-interview. Mothers who met the above-mentioned criteria following the pre-interview and who completed the consent form were included in the study.

### Reading the Mind in the Eyes Test

The Reading the Mind in the Eyes Test, developed by Baron-Cohen *et al.* (1997) and revised in 2001 in order to evaluate emotional recognition abilities, consists of thirty-six images consisting of facial contours. Participants are asked to select one among four items that best express the mental state of the person depicted in the image. Adaptation of the test for the Turkish population was completed by Yildirim *et al.* (2011). The Turkish adaptation of the test consists of only 32 items because two articles generated consistent replies in the pilot

Descriptive statistics such as frequency, arithmetic mean, and standard deviation, were calculated using SPSS PC 15.0 for Windows. An independent groups Student's t-test was used to evaluate differences in variables that followed a normal distribution and the Mann Whitney U test was used to evaluate variables that did not follow a normal distribution in the comparison of continuous variables between groups. A P value less than 0.05 was considered statistically significant.

**Findings** The demographic characteristics of the groups are as follows: the average age of mothers of patients with schizophrenia was  $55.40 \pm 6.3$  years and the average number of years of education was  $5.69 \pm 3.8$ ; in the control group, the average age was  $52.19 \pm 6.6$  years and the average number of years of education was  $7.04 \pm 4.26$ . A nonparametric test was used to examine differences between the groups because education and age did not follow a normal distribution. No statistically significant difference in education was found between the two groups ( $p=0.147$ ). The difference in age was significantly different between the two groups ( $p=0.021$ ).

A total of eleven mothers of schizophrenia patients and seven control group participants were using antidepressants at the time of the study. In the clinical interviews it was determined that use of antidepressants was caused by anxiety and depressive mood and was not accompanied by psychotic experiences. No significant difference in anti-depressant use was found

**Table 1.** Comparison of demographic data and number of antidepressant users among groups

|                         | Mothers of schizophrenics | Control group   | p       |
|-------------------------|---------------------------|-----------------|---------|
| Age                     | $55.40 \pm 6.3$           | $52.19 \pm 6.6$ | 0,021*  |
| Education Level (years) | $5.69 \pm 3.8$            | $7.04 \pm 4.26$ | 0,147*  |
| Antidepressant Intake   | 7                         | 12              | 0,292** |

\* Mann Whitney U test

\*\* Chi-square test

study and two items were considered to have low reliability in the validity - reliability study. The test was performed in a room suitable for clinical interviews, with only the interviewer and the subject present. After the "test" item was completed according to the instructions given by the interviewer, the subject was provided with a mini "dictionary" including the meanings of words used in the test. The the subject was expected to select the item best representing the viewed image from among three distractors and one correct response. Items in the test were classified as positive, negative, or neutral mental representations.

## Statistical analysis

**Table 2.** Effects of antidepressant intake on Eyes Test performance within groups\*

|                          | Mothers of schizophrenics | Control Group    |
|--------------------------|---------------------------|------------------|
| Antidepressant intake    | $15.09 \pm 3.90$          | $22.42 \pm 4.64$ |
| No antidepressant intake | $15.62 \pm 4.64$          | $18.42 \pm 4.98$ |
| p                        | 0,069                     | 0,716            |

Independent-samples t Test

\* Total Eyes Test scores were compared.

between the two groups ( $p = 0.292$ ). In addition, the use of anti-depressants did not have a significant effect on eye test performance among groups (Table 2).

We observed a statistically significant difference ( $p=0.001$ ) between mothers of schizophrenia patients and the control group in Eyes Test results. As seen in Table 3, mothers of schizophrenia patients exhibited significantly lower performance ( $t=-3.495$ ) in the Eyes Test relative to the control group.

Although the Reading the Mind in the Eyes Test gives a standard result minimizing the effect of the researcher with respect to other tasks measuring the theory of mind ability, analysis of qualitative data is not possible because the evaluation is made through the aggregate of correct answers to the

articles despite the fact that it contains articles with different emotional valence. Harkness *et al.* (2005) have divided test articles into 3 categories as negative, positive and neutral, in order to partially overcome this limitation of the test. When we compared the responses to negative, positive, and neutral items in the control group and among mothers of schizophrenia patients based on the categorization used by Harkness *et al.* in their study, no significant difference was observed in the response to negative images ( $p=0.134$ ). However, mothers

**Table 3.** Comparison of Eyes Test performance

|                            | Mothers of<br>schizophrenics | Control Group | p     |
|----------------------------|------------------------------|---------------|-------|
| Eyes- Total                | 15,48±4,43                   | 19,02±5,09    | 0,001 |
| Eyes-Neuter                | 7,30±2,57                    | 9,12±2,55     | 0,001 |
| Eyes- Positive             | 3,09±1,25                    | 4,10±1,50     | 0,001 |
| Eyes- Negative             | 5,09±1,94                    | 5,78±2,35     | 0,134 |
| Independent-samples t Test |                              |               |       |

of schizophrenia patients showed significantly lower performance with respect to the control group in recognizing neutral ( $p=0.001$ ) and positive ( $p=0.001$ ) emotions (Table 3).

## DISCUSSION

In the present study, mothers of schizophrenia patients exhibited significantly lower performance in the Eye test relative to control subjects. No previous study has examined eye test performance among the mothers of schizophrenia patients. Theory of the mind performance is lower among first-degree relatives of schizophrenia patients with respect to control subjects, in previous studies using false belief tests (Anselmetti 2009, De Achával 2010, Riveros 2010 and Yucel 2009). Results of the meta-analysis study carried out by Bora and Pantelis (2013), including 10 studies comparing first degree relatives of schizophrenia patients ( $n=2,388$ ) and control subjects ( $n=929$ ), indicate that unaffected first degree relatives of schizophrenia patients exhibited poor performance on theory of mind tests relative to control subjects

The number of studies carried out using the Eyes Test is limited. While no significant difference was reported in some previous studies using the Eyes Test in schizophrenia patients and first-degree relatives (Kelemen 2004, Riveros 2010 and Penteraki 2012), others have suggested a statistically significant difference in performances of relatives of patients and control subjects. No significant difference in the Eyes Test performance was observed in the meta-analysis by Bora and Pantelis (2013), which included first-degree relatives of schizophrenia patients; however further studies are necessary to clarify this issue. The number of studies specifically examining the

mothers of schizophrenia patients is limited. A study conducted by Penteraki (2012) reported no significant difference in Eye test performance among the parents of schizophrenia patients relative to control subjects. However it should be noted that the study was carried out with a limited sample size.

An alternate study design was conducted by Ragsdale and Foley (2011). The research compared the Eyes Test performance of siblings with same mother and father to half-siblings different fathers and half-siblings with different mothers. The results of the study indicated a maternal influence on Eyes Test performance. The fact that a significant difference in the Eyes Test performance between mothers of schizophrenia patients and the control group was detected in our study may indicate that deficits in theory of mind functions are a specific endophenotype for schizophrenia, as suggested by many previous studies. On the other hand, the findings are also consistent with the mentalization literature, which points to the role of the primary care giver in the development of the mentalization capacity of the child. The question of whether the mentalization ability of the mother is a factor affecting developmental processes or is an endophenotype for schizophrenia remains to be answered in future studies.

When Eyes Test items were categorized as positive, negative, and neutral, no significant difference was observed between the control group and mothers of schizophrenia patients in the recognition of negative emotions. However, a remarkable difference in the recognition of positive and neutral emotions was observed. This indicates that mothers of schizophrenia patients had difficulty in recognizing positive and neutral representations rather than negative mental representations. From an evolutionary perspective, these may point to the survival importance of recognizing threats. In addition, the fact that negative mental representations are maintained in schizophrenia patients while on the other hand positive and neutral representations, which are important in social interaction, are not adequately developed, may be related to the deficit in theory of mind functions of mothers of schizophrenia patients. However, due to the lack of studies on this issue, any comments are mostly of a speculative nature and are subject to verification or falsification by future studies.

The Eyes Test standardization study indicated that the ratio of correct responses is significantly influenced by the level of education. Therefore, the fact that no significant difference in total number of years of education was observed between the mothers of patients and the control group is important in validating the present study (Yıldırım *et al.* 2011). Mean age differed significantly between the two groups. Although this difference may be a limitation in interpreting the results of the study, it can be assumed that the affect of this difference on the results of the study is limited, taking into consideration that both groups in the study had a similar age range (control group 40-64; sample group 41-65), that the Eyes Test

measures emotional elements rather than cognitive elements, and that no previous studies have indicated that age has any significant affect on test performance. Theory of mind functions are affected by mood (Inoue 2004, Wang 2008, Zobel 2010, Marshall 2011). Serving as caregiver of an individual with schizophrenia, is a significant source of stress and the absence of measures reflecting differences in mood among study subjects may limit the interpretation of this study. Evaluation of moods in future studies may provide more reliable results.

Although inclusion of mothers using antidepressants in the sample group may be considered a limitation we assume that it has a limited affect. Antidepressant users did not differ significantly from individuals not taking antidepressants in terms of Eyes Test performance. An effort was made to select mothers with similar educational levels, however the absence of specific measurements of intelligence may be considered a limitation of the present study. In order to compensate that effect, only mothers with fluent literacy were included in the study and mothers with an observable mental deficiency were excluded.

### Conclusion

Although the importance of genetic factors has been emphasized in schizophrenia, it is known that environmental factors have an important influence in the development of the illness (Ertuğrul 2007). Studies carried in schizophrenia patients and their first-degree relatives indicate that theory of mind deficit may be a risk factor for schizophrenia. In addition studies on contribution of parents to the mentalization processes of children indicate that the similar phenomena may be considered as an environmental-developmental factor. Studying theory of mind skills of mothers, as indicated by previous studies to be an endophenotype in schizophrenia, may help us understand environmental-developmental factors better. We found that mothers of schizophrenia patients exhibited significantly poorer performance in the Eyes Test compare to control subjects with children with no history of mental illness. In the advanced analysis, the difference may be attributed to differences in the ability to recognize positive and neutral emotions among the mothers of schizophrenia patients. The data collected in our study indicates that mothers of schizophrenia patients may differ from control subjects in various aspects of theory of mind processes; these deficiencies may be important in schizophrenia pathogenesis as a developmental-environmental factor or endophenotype and should be tested taking different biological markers into account. Future studies may examine performances of parents of schizophrenia patients, who are early period primary care givers, and siblings. Alternately, studies comparing theory of mind performances of schizophrenia patients raised separately from birth parents, with birth parents, or with step-parents could help to differentiate between genetic and

environmental influences. Future studies will help us better understand the role of genetic and environmental-developmental factors on the theory of mind.

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