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Impaired performance of Reading the Mind in the Eyes Test in clinical high risk for psychosis and first-episode psychosis

정신증 고위험군과 초발 정신증 환자군에서의 눈으로 마음 읽기 과제 수행 손상에 관한 연구

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Abstract

Background: Although previous studies reported schizophrenia patients showed impaired performances in Reading the Mind in the Eyes Test (RMET), which measures complex emotion recognition abilities, reports regarding the individuals at high risk of psychosis have been inconsistent mainly due to heterogeneous subject characteristics. To examine whether the RMET performance is impaired from the early phase of the psychotic disorder, we compared RMET scores across the first-episode psychosis (FEP), clinical high risk (CHR) for psychosis, and healthy controls (HCs).

Methods: A total of 25 FEP, 41 CHR, and 44 HC subjects matched for age participated in this study. RMET task was administered and performance scores were compared across the groups using the analysis of variance with covariates of intelligent quotient, sex, education years, and olanzapine equivalent dose of antipsychotics. Exploratory Pearson's correlation analysis was performed to reveal the potential relationship between the RMET scores and clinical symptom severity in FEP patients and CHR subjects, respectively.

Results: RMET performance scores were significantly lower in FEP and CHR participants compared to HCs. FEP patients and CHR subjects showed comparable RMET performance scores. Exploratory Pearson's correlation analysis revealed that RMET scores were negatively correlated with the Positive and Negative Syndrome Scale (PANSS) positive symptom subscale scores in FEP patients.

Discussion: Considerably impaired RMET function is present from the risk stage of psychosis and this might be related with positive symptom severity. Longitudinal study

would be necessary to confirm the stability of the complex emotion recognition impairments and its relationship with social functioning in early psychosis patients.

Keywords: Schizophrenia, Clinical high-risk for psychosis, First-episode psychosis, Theory of mind, Reading the Mind in the Eyes Test (RMET)

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Introduction

1.1 Study background

Schizophrenia is a debilitating psychiatric illness with the lifetime prevalence from 0.3 % to 0.7% of global population (Saha et al., 2005). Schizophrenia represents wide range of symptoms including distortions of perception (i.e., hallucinations and delusions), flattened and reduced affective functioning and various cognitive dysfunctions. Before the full onset of the disease, social dysfunction emerges early in the course of schizophrenia (Porcelli et al., 2019). The social dysfunctions present in the broad spectrum of daily living, such as the problems of independent living, social problem solving, and interpersonal behaviors (Couture et al., 2006). Such social dysfunctions are thought to affect well-being and quality of life of schizophrenia patients (Burns and Patrick, 2007), and such impairments are associated with transition to the illness in subjects at clinical high risk (CHR) for psychosis and treatment prognosis (Cornblatt et al., 2012).

Many researchers have been seeking factors that explain social dysfunctions of schizophrenia. In a meta-analysis study, it was found that social cognition is more strongly related to social functioning than neurocognition (Fett et al., 2011). Social cognition refers to the mental operations underlying social behaviors being comprised of four main domains: emotional processing, social perception and knowledge, theory of mind (ToM), and attributional bias (Green et al., 2008). Among these four domains, ToM explains the largest portion of functional outcome in the schizophrenia patients (Fett et al., 2011).

ToM refers to the ability to infer beliefs, intentions, and emotion of others (Schaafsma et al., 2015). ToM is less a unitary concept than an integrated one that is comprised of many different psychological processes such as attention to the eye gaze, perceiving facial emotions and understanding of causality of events, and each process is represented in the distinctive neural bases (Schurz et al., 2014, Schaafsma et al., 2015). Because ToM implements many sub-processes, property of tasks for measuring ToM should be carefully considered (Bora et al., 2009).

ToM tasks could be largely divided into two main categories – reasoning and complex emotion recognition (Mitchell and Phillips, 2015). Most of the ToM tasks, such as Hinting tasks, Story tasks, False belief tasks and The Awareness of Social Inference Test (TASIT) fall into the reasoning tasks which consists of inferring others' beliefs or intentions by integrating contextual information and character's traits by means of semantic comprehensive abilities (Sabbagh et al., 2004, Bora et al., 2006). When reasoning ToM was measured in CHR individuals, first-episode psychosis (FEP) and chronic schizophrenia patients, meta-analyses studies demonstrated all groups showed significantly lower performance than that of healthy controls (HCs) (Bora et al., 2009, Bora and Pantelis, 2013). Reasoning ToM performance of CHR group was moderately impaired and is known to be worsened at the illness onset (Bora and Pantelis, 2013, Lee et al., 2015b). However, it has been suggested that many non-social cognitive components (i.e. general cognitive ability), such as intelligent quotient (IQ), working memory, executive function, may affect reasoning ToM ability in early psychosis patients, thus reasoning ToM dysfunction could be secondary to the general cognitive dysfunctions (Chung et al., 2008, Hur et al., 2013, Zhang et al., 2018).

On the other hand, Reading the Mind in the Eyes Task (RMET) assesses complex emotion recognition abilities to perceive others' emotions through the eyes (Baron-Cohen et al., 2001). Contrary to the basic emotions (e.g. happiness, sadness, anger, surprise, disgust and feat), complex emotions (e.g. shame, pride) are more subtle and advanced emotions essential to form sophisticated social relationships throughout life (Blakemore and Mills, 2014, Garcia and Scherf, 2015). This ability is comprised both of cognitive and perceptual processes, for instance, verbal understanding, eye gaze perception, or facial emotion perception (Schaafsma et al., 2015, Meinhardt-Injac et al., 2018). However, perceptual aspects are thought to be more vital because RMET depends on imminent, observable information (Bora et al., 2006, Sabbagh et al., 2004). For these reasons, RMET draws more automatic, instant response than reasoning ToM tasks which means that RMET is a more proximal task to the real-world functioning in psychosis patients (Bora et al., 2006, Sabbagh et al., 2004, McGlade et al., 2008). Therefore, the perceptual components make RMET less subjective to the general cognitive abilities and more representative of real-world social cognitive functioning in psychosis patients (McGlade et al., 2008, Sabbagh et al., 2004, Schurz et al., 2014).

Impaired RMET performance has been consistently reported in chronic schizophrenia and FEP patients (Bora et al., 2009, Bora and Pantelis, 2013, Chung et al., 2014). However, in CHR, previous studies did not reach clear conclusions in that two studies with controlled IQ across the groups reported intact RMET performances (Couture et al., 2008, Stanford et al., 2011), whereas two studies from same research group without measuring the IQ scores but with matching age of participants reported significant impairments in CHR subjects (Zhang et al., 2016, Zhang et al., 2018). Such inconsistencies may be explained by the fact that social cognitive performances in CHR

individuals are affected by two important interacting confounders of general cognitive abilities and age (Thompson et al., 2011). It has been suggested that the influence of general cognitive abilities on social cognitive performances is larger during adolescents that after adulthood (Choudhury et al., 2006, Decety, 2010, Kilford et al., 2016). However, previous studies which compared RMET performances between CHR subjects, who are mostly in adolescents and early adulthoods when general cognitive abilities affect social cognition, and schizophrenia patients and healthy controls (HCs), who are mostly in adulthoods when general cognitive abilities less affect social cognition, did not control age and IQ at the same time (Atkinson et al., 2017, Couture et al., 2008, Stanford et al., 2011, Zhang et al., 2016, Zhang et al., 2018).

Furthermore, little is known for the association between RMET performances and psychotic symptom severity in early psychosis patients. Three previous studies reported that they did not find significant relationship of RMET performances with symptomatic severity in FEP patients (Ayesa-Arriola et al., 2016) and CHR subjects (Couture et al., 2008, Stanford et al., 2011), whereas another study reported association between RMET performance with psychotic symptom severity in FEP patients (Vohs et al., 2014) and help-seeking individuals (Guastella et al., 2013) that conceal the clear role of complex emotion recognition on psychotic symptoms.

1.2. Purpose of the research

In current study, we compared RMET performance of age matched patients with FEP, subjects at CHR for psychosis, and HCs, to confirm that whether impairments in complex emotion recognition ability measured by RMET is present from the CHR status after controlling the interacting effect of general cognitive abilities and age. In addition, to reveal the possible relationship between complex emotion recognition abilities and

psychotic symptoms in these clinical population, exploratory correlation analysis between symptomatic severity and RMET performances was performed in CHR and FEP groups, respectively.

2. Methods

2.1. Participants and clinical assessments

A total of 25 FEP patients, 41 CHR individuals, and 44 HCs matched for age participated in this study. Study participants were recruited from the prospective and longitudinal high-risk cohort study conducted at the Seoul Youth Clinic in Seoul National University Hospital (SNUH), and made initial contact by telephone, website (http://www.youthclinic.org), or local clinic (Kwon et al., 2012). HCs were recruited through an Internet advertisement and screened with SCID-I Non-Patient Edition (SCID-NP) axis I diagnoses. HCs with family history of psychotic disorder was excluded from the study. The abbreviated version of the Korean-Wechsler Adult Intelligence Scale was used to measure IQ in all participants (Kim, 1994). Common exclusion criteria included intellectual disability (IQ <70), history of substance use disorder, neurological disease, head trauma with loss of consciousness, seizure, or any other significant medical illnesses.

FEP patients were defined when they met a diagnosis of schizophreniform disorder, schizophrenia, or schizoaffective disorder according to the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-VI) criteria, and duration of illness was less than 2 years. The Positive and Negative Symptom Scale (PANSS) were administrated to assess the psychotic symptom severity. The CHR subjects were assessed using the validated Korean version of Structured Interview for Prodromal Symptoms (SIPS) (Jung et al., 2010, Miller et al., 2002). The prodromal status was confirmed if the participants met at least one of the three criteria: (1) attenuated positive symptoms (APS) (2) the presence of brief intermittent psychotic symptoms (BIPS) (3) genetic risk with deterioration (GRD). Severity of prodromal

psychotic symptoms were assessed using the Scale of Prodromal Symptoms (SOPS) (Jung et al., 2010, Miller et al., 2002). Intensive clinical interview was conducted using Structured Clinical Interview for the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition Axis I disorders (SCID-I) to identify past and current psychiatric illnesses by experienced psychiatrists. To define general functional status, the Global Assessment of Functioning (GAF) was administered to both CHR and FEP. Medication prescription at the time of enrollment was reviewed through the electronic medical record. At the time of assessment, 88% (n = 22) of FEP patients were receiving atypical antipsychotic medication, and mood stabilizer was prescribed in 1, antidepressants were in 3, and anxiolytics were in 14 patients. At the time of the enrollment, 17% (n=7) of CHR subjects were receiving antipsychotic medicine, and mood stabilizers were prescribed in 3, antidepressants were in 11, anxiolytics were in 12 CHR subjects. Dose of antipsychotic medication prescribed was calculated as mean olanzapine equivalent dose (Gardner et al., 2010). Mean daily dose for FEP in olanzapine equivalent was 11.9 ± 10.3 mg and for CHR was 0.6 ± 2.2 mg.

This study was conducted according to the Declaration of Helsinki and was approved by the Institutional Review Board of SNUH (IRB no. H-1912-108-108). Each subject received a complete description of the study and provided written informed consent before participation in the previous prospective cohort study (IRB no. H-1201-008-392). For the minors who participated in this study, informed consent was obtained from both the participants themselves and their parents.

2.2. Reading the mind in the eyes task

A Korean version of the RMET derived from Baron-Cohen (Baron-Cohen et al., 2001) was used to assess the complex emotion recognition abilities in all participants. It comprises 36 photographs of eyes of Korean actors and actresses from the movies with various expressions.

All photos in the study were black and white and each photo was 15cm x 6cm size **(Figure 1)**. For each item, participants were asked to choose one of four words that describes the expression in the eyes the best. There were no time limits, and all emotional words were in conformity with Baron-Cohen's original task. The RMET performance scores were calculated by the sum of the number of correct answers.

2.3. Statistical analysis

The statistical analyses were performed using the SPSS v.25.0 (IBM, Armonk, NY). Statistical significance was set at $p < 0.05$. Demographic characteristics were compared using the analysis of variance (ANOVA) across the FEP, CHR, and HC groups for continuous variables. Chi square test was used for categorical variables. Clinical characteristics including symptomatic severity and olanzapine equivalent dose of antipsychotics were compared using independent samples t-test in FEP and CHR groups. Univariate analysis of covariance (ANCOVA) test was conducted to examine the group difference of RMET performance. Covariates included for ANCOVA were sex which was significantly different across the groups. IQ was also used as a covariate because RMET is known to have a correlation with general intelligence in normal population (Baker et al., 2014), and to control the possible confounding effect of general cognitive abilities in youth with early psychosis (Thompson et al., 2011). Bonferroni correction was applied for a *Post-hoc* analysis. Exploratory Pearson's correlation analysis was performed to reveal the potential relationship between RMET performance scores and symptomatic severity in FEP and CHR groups, respectively.

3. Results

3.1. Demographic and Clinical Characteristics

There was a significant group difference in sex, with more females in the FEP than CHR and HC groups (χ^2 = 11.871, p = .003). There was no significant difference in age and education across all groups. General functional status measured by GAF was not different between FEP and CHR participants (t = 0.816, p = 0.417). In addition, FEP patients were receiving larger olanzapine equivalent dose of antipsychotic medications than CHR subjects (t = 6.793, p < 0.001). **Table 1** summarized the characteristics of the subjects.

3.2. Group differences of RMET performance

Group comparison results of RMET performance scores is presented in **Table 2** and **Figure 2**. ANCOVA was conducted to examine difference in RMET performance across groups. The ANOVA with sex and IQ as covariates revealed that there was significant group difference of RMET performance scores across the FEP, CHR, and HC groups ($F_{2,105}$ = 5.174, p = 0.007). *Post-hoc* Bonferroni correction showed that both FEP patients (p = 0.013) and CHR individuals (p = 0.049) showed significantly lower RMET performance scores than HCs. There was no group difference of RMET scores between FEP and CHR participants (p = 1.000).

3.3. Exploratory correlation analysis results

Exploratory Pearson's bivariate correlation analyses were conducted to investigate potential relationship of RMET performance scores and clinical symptom severity in FEP and

CHR groups, respectively. Relationships between RMET score and clinical features in CHR and FEP were represented in **Table 3**. PANSS positive symptom subscale scores were negatively correlated with RMET performance scores (r = -0.420, p = 0.040) in FEP patients (**Figure 3**). In CHR group, no significant correlation was found between RMET performance scores and SOPS subscale scores.

4. Discussion

RMET is a useful tool to measure complex emotion recognition, with its study characteristic being intuitive (i.e., requires little semantic or reasoning abilities) and carrying meaningful features of interpersonal relationships (Baron-Cohen et al., 2001). While impaired RMET performances in chronic schizophrenia and FEP patients is quite solid (Bora et al., 2009, Bora and Pantelis, 2013, Chung et al., 2014), existing literature regarding the CHR group have been reported inconsistent results (Atkinson et al., 2017, Couture et al., 2008, Stanford et al., 2011, Zhang et al., 2016, Zhang et al., 2018). These inconsistencies may partly be due to the interacting confounding effects of general cognitive abilities and age upon RMET performance (Thompson et al., 2011), which was not controlled in previous studies. To address the issue, we examined RMET performances in the age-matched group of FEP, CHR, and HCs with controlling the IQ, and found impaired performances of RMET in both the FEP and CHR group to a similar degree compared to HCs. In addition, exploratory correlation analysis found that RMET performances in FEP patients were negatively correlated with the positive symptomatic severity as measured by PANSS.

RMET performance differences across groups

In the current study, complex emotion recognition remained impaired in age matched CHR and FEP compared to HCs after controlling IQ. Our results were different from previous studies in which they reported intact RMET performance in CHR (Atkinson et al., 2017, Couture et al., 2008, Stanford et al., 2011). A wide range of participants' age in the three prior studies might have disguised the true ability of complex emotion recognition in CHR. In fact, social cognitive abilities including complex emotion recognition develop rapidly during the adolescence and early adulthood (Dodell-Feder et al., 2020, Garcia and Scherf, 2015) and

relevance of general cognition on social cognition is changed in the course of the development, being more engaged in the young than it is in the adults (Choudhury et al., 2006, Decety, 2010, Kilford et al., 2016). Because CHR and FEP are largely distributed across the adolescence and adulthood, comparing RMET performance with the age-matched subjects when IQ was also adjusted might have enabled us to observe the obvious impaired complex emotion recognition in the clinical groups.

It is noteworthy that RMET performance impairments observed in CHR were comparable to those of FEP after IQ was controlled. The nature of RMET, which requires instant perceptive abilities (i.e., eye gaze and face recognition) and less semantic reasoning, might be attributable to the imapaired RMET performance in CHR with the similar degree of FEP patients (Bora et al., 2006, Sabbagh et al., 2004, Schaafsma et al., 2015). Previous studies have demonstrated visual and facial perceptual deficits in CHR are comparably substantial to those of FEP and chronic schizophrenia groups (Kimhy et al., 2007, Lee et al., 2015a). Therefore, the comparably impaired RMET performance in CHR and FEP might be representing significant perceptual disturbances not fully compensated by other general cognitive functions such as IQ.

Association between clinical symptoms and RMET scores

We found significant negative association between positive symptom severity and RMET performance in FEP patients. The current study result is in line with the provided mechanism of sustained psychotic symptoms by previous study which suggested that distortion in emotion recognition could contribute to the maintenance of faulty attribution or delusions (Couture et al., 2006). On the other hand, a prior study reported significant association between RMET performance and negative symptoms in FEP patients (Vohs et al., 2014), which was not found in our study. However, according to the Guastella et al. study, while

RMET performance was related to both of the positive and negative symptoms, it only significantly predicted positive symptom severity when IQ and other neurocognitive abilities such as verbal learning and sustained attention were considered (Guastella et al., 2013). In our study, there was no significant difference of IQ across groups, which meant that general intelligence of our FEP group was relatively intact that could account for the effaced association between negative symptoms and RMET scores.

Limitations

There exists several limitations of the study. First, relatively small number of participants were included in the FEP group compared to CHR and HC groups in purpose of matching the age. Second, there was significantly more females in FEP group compared to other two groups and most of the patients with FEP were taking antipsychotic medication at the time of RMET participation. However, previous meta-analysis studies demonstrated that sex and antipsychotic medication were not the factors explaining impaired social cognition in schizophrenia patients (Bora et al., 2009, Chung et al., 2014). Although we used sex as covariate in group comparison analysis, the result of current study should be interpreted with caution in consideration with potential confounding effect of sex and antipsychotic medication on RMET performances. Third, because of the cross-sectional study design, we could not address the longitudinal change of RMET performance according to the different stages of early psychosis.

Conclusion

In conclusion, this study first demonstrated similarly impaired complex emotion recognition abilities in age-matched group of FEP and CHR after controlling the potential

confounding effect of IQ compared to HCs. In addition, the impairment in RMET performance did not differ between CHR and FEP group, which suggests substantial impairment in recognizing complex emotions thorough the eyes begins to present from the prodromal stage of illness. Furthermore, RMET performance in the FEP group was associated with positive symptoms, which suggests appropriate treatment to allay positive symptoms may aide in perception of subtle interpersonal emotions in this group. Future longitudinal study with age, sex, and IQ matched, medication naïve participants would be warranted to confirm the current study results.

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Table 1. Demographic and clinical characteristics of patients with first-episode psychosis (FEP), subjects at clinical high risk (CHR) for psychosis, and healthy controls (HCs).

	FEP	CHR	HC	Statistical analysis[a]		*Post-hoc* analysis[b]		
	(N = 25)	(N = 41)	(N = 44)	F or T or $\chi2$	P	FEP vs CHR	FEP vs HC	CHR vs HC
Age (years)	22.9 ± 3.9	21.2 ± 3.1	21.8 ± 3.4	1.684	0.190	0.208	0.741	1.000
Sex (male/female)	10/15	31/10	34/10	11.871	0.003**	-	-	-
IQ	105.3 ± 15.9	104.0 ± 12.2	109.0 ± 11.0	1.673	0.193	1.000	0.794	0.233
Education (years)	14.2 ± 2.1	13.1 ± 1.6	13.9 ± 1.8	3.234	0.043*	0.060	1.000	0.181
PANSS								
Positive symptoms	13.6 ± 5.5	-	-	-	-	-	-	-
Negative symptoms	15.0 ± 7.0	-	-	-	-	-	-	-
General syptoms	29.0 ± 10.3	-	-	-	-	-	-	-
SOPS								
Positive symptoms	-	11.6 ± 4.0	-	-	-	-	-	-
Negative symptoms	-	14.3 ± 6.3	-	-	-	-	-	-
Disorganization	-	4.5 ± 3.6	-	-	-	-	-	-
General symptoms	-	7.6 ± 4.1	-	-	-	-	-	-
GAF	54.8 ± 16.2	52.2 ± 9.1	-	0.816	0.417	-	-	-
Antipsychotics dose[c]	11.9 ± 10.3	0.6 ± 2.2	-	6.793	<0.001**			

Abbreviations: IQ, intelligence quotient; PANSS, positive and negative syndrome scale; SOPS, scale of prodromal symptoms; GAF, global assessment of functioning.

*. The mean difference is significant at the 0.05 level.

**. The mean difference is significant at the 0.005 level.

[a] Analysis of variance, independent t test or Welch's t test if the variances were not equal, $\chi2$ analysis or Fisher's exact test for categorical data.

[b] Post-hoc Bonferroni correction analysis.

[c] Olanzapine equivalent dose of antipsychotics prescribed at the time of enrollment.

Data are given as mean ± standard deviation.

Table 2. Results of reading the mind in the eyes test (RMET) across the three groups.

	FEP	CHR	HC	Statistical analysis[a]		*Post-hoc* analysis[b]		
	(N = 25)	(N = 41)	(N = 44)	F	P	FEP vs CHR	FEP vs HC	CHR vs HC
RMET scores	22.8 ± 5.2	23.4 ± 3.8	25.8 ± 3.0	5.174	0.007*	1.000	0.013*	0.049*

Abbreviations: FEP, first-episode psychosis; CHR, clinical high risk; HC, healthy control.

[a] Analysis of variance with sex and intelligence quotient as covariates.

[b] *Post-hoc* Bonferroni correction analysis.

Data are given as mean ± standard deviation.

*. The mean difference is significant at the 0.05 level.

Table 3. Exploratory Pearson's correlation analysis between the reading the mind in the eyes test (RMET) scores and symptomatic severity.

Group	Clinical assessment	r	P
FEP	PANSS positive symptoms	-0.419	0.037*
	PANSS negative symptoms	-0.377	0.064
	PANSS general symptoms	-0.325	0.113
CHR	SOPS positive symptoms	-0.012	0.939
	SOPS negative symptoms	-0.300	0.056
	SOPS disorganization	-0.065	0.685
	SOPS general symptoms	-0.147	0.358

Abbreviations: FEP, first-episode psychosis; CHR, clinical high risk; PANSS, positive and negative syndrome scale; SOPS, scale of prodromal symptoms.

*. The mean difference is significant at the 0.05 level.

Figure 1. The example of Korean version of the reading the mind in the eyes test (RMET).

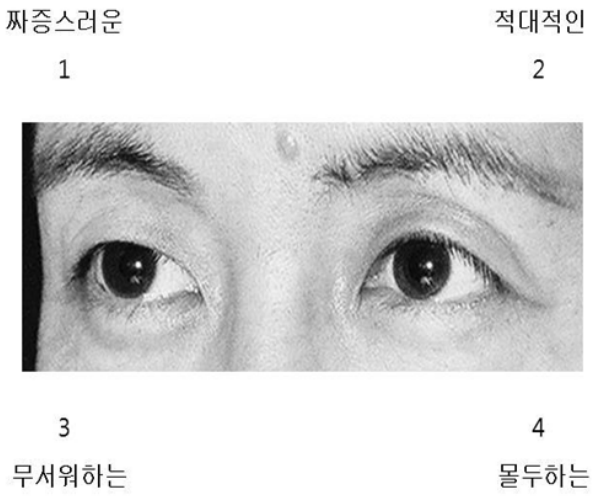


Figure 2. Group comparison of the reading the mind in the eyes test (RMET) performance across the first-episode psychosis (FEP), clinical high risk (CHR) for psychosis, and healthy control (HC). The horizontal lines for each group indicate the means, and the vertical lines for each group indicate the 95% confidence interval. * indicates that the mean difference is significant at the 0.05 level.

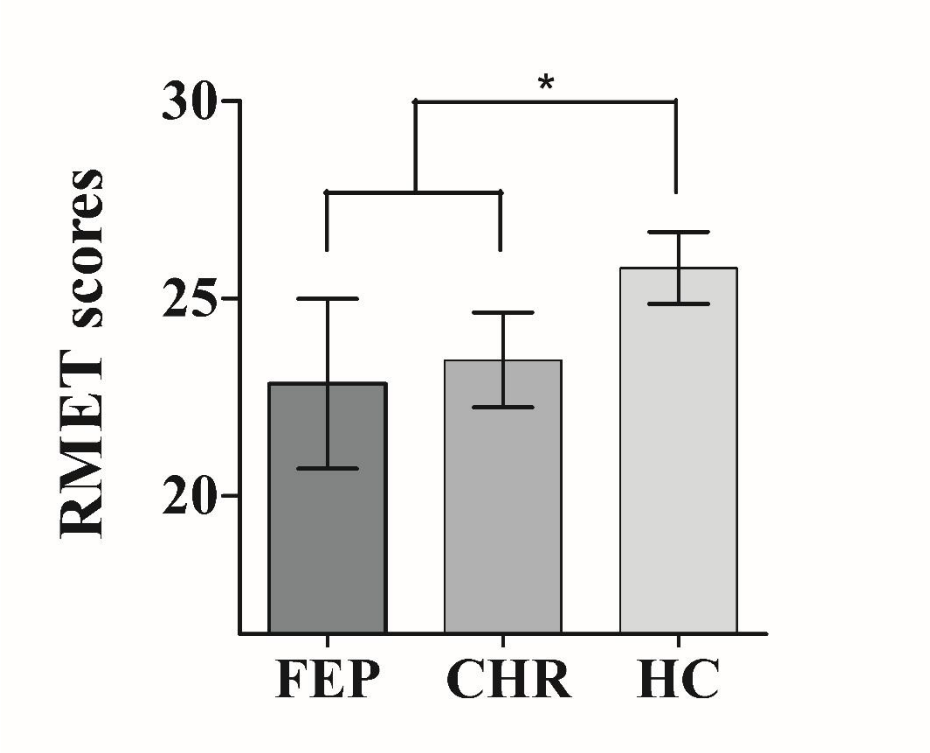
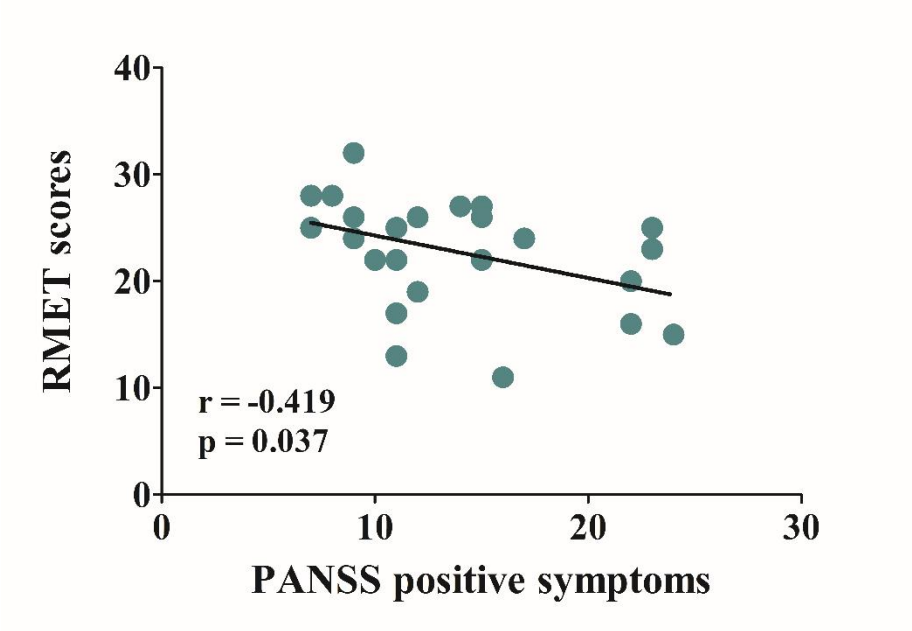


Figure 3. The pearson correlation of the positive symptom and Reading the Mind in the Eyes Test (RMET) score in patients with first-episode psychosis (r = -0.42, p = 0.04). PANSS, Positive and Negative Syndrome Scale.



초록

Background: 조현병 환자들을 대상으로 한 이전 연구들에서는 눈으로 마음 읽기 과제 (RMET) 를 통해 복잡한 감정을 인식하는 능력이 저하되어 있음을 보고하였다. 그러나 조현병 이전 단계인 고위험군에서는 연구에서 모집된 참가자들의 특성이 이질적이었고, 이에 따라 연구마다 RMET 수행에 관한 불일치한 결과를 보고하였다. 본 연구에서는 RMET 수행이 정신증의 이전과 초기 단계에서부터 저하되어 있는지 알아보기 위해 첫 발병 정신증, 정신증 고위험군, 정상 대조군을 모집하여 본 과제의 수행을 그룹별로 비교하였다.

Methods: 나이가 매칭된 25명의 초발 정신증 환자, 41명의 정신증 고위험군, 44명의 정상 대조군이 이 연구에 참여하였다. 세 그룹 모두 RMET를 수행하였고, IQ, 성별, 약물, 교육 년 수를 공변량 분석을 통해 보정한 뒤 RMET 점수가 그룹 간 차이가 이는지 분석하였다. 피어슨 상관분석을 통해 고위험군과 초발 정신증 환자들에서의 RMET 수행과 증상 간의 관련성이 있는지도 알아보고자 하였다.

Results: 초발 정신증 환자와 정신증 고위험군 대상자들의 RMET 수행 점수는 정상 대조군과 비교할 때, 유의하게 낮았고, 정신증 고위험군과 초발 정신증 환자들의 RMET 점수는 서로 비슷한 정도로 떨어져 있었다. 정신증 고위험군에서는 RMET 수행과 증상 간의 유의미한 관련성을 발견하지 못했지만, 초발 정신증 환자에서는 양성 증상이 RMET 수행과 유의미한 부적 상관성을 가졌다.

Discussion: 본 연구를 통해 정신증 고위험군 단계에서부터 초발 정신증 환자군과 비슷한 정도로 RMET 수행이 떨어져 있음을 알 수 있었다. 또한 본 연구 결과는 초발 정신증 환자군에서 RMET 수행은 양성 증상 심각도와 관련이 있음을 시사한다. 조기 정신증 환자들에서 복잡한 감정 인식 능력의 손상이 질환이 진행됨에 따라 진행하는지와 실제 사회 기능와의 관련성을 증명하기 위해서는 후속 종단 연구가 필요하다.