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EVALUATION OF COGNITIVE FUNCTIONS IN SCHIZOPHRENIC PATIENTS WITH THE MONTREAL COGNITIVE ASSESSMENT SCALE AND MINI-MENTAL STATE EXAMINATION

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Abstract: Schizophrenia is a complex neurodevelopmental disorder. Cognitive deficit is the central feature of the neurodevelopmental disorders. Cognitive impairment is related to social, functional, and clinical symptoms. The aim of this study was to investigate the clinical usability of the Montreal Cognitive Assessment (MoCA) as a screening instrument for cognitive impairment in schizophrenic patients alone, and in correlation with the Mini-Mental State Examination (MMSE). This clinical study included 31 patients diagnosed with schizophrenia. Patients were selected from Psychiatry Clinic. For the assessment of cognitive impairment, we used Montreal Cognitive Assessment Scale (MoCA) and Mini-Mental State Examination (MMSE). Of the total number of patients (n=31), 6/31 (19.4 %) were males and 25/31 (80.6 %) were females; the mean duration of the disorder was 23.5 years (SD=6.69). Seventeen patients (54.8%) of those who were on MMSE scale had a score greater or equal to 24 (normal range) and the MoCA scale had a normal score (>21), while 11 (35.5%) patients reported moderate to severe cognitive impairment. Analysis of the correlation coefficient between the total score of MoCA and the MMSE scale indicates a statistically significant positive correlation with Spearman rho=0.81 and P<0.001. Our findings provide preliminary evidence that the MoCA scale performs well in screening mild and moderate cognitive impairments of schizophrenia patients in outpatient clinics and is more sensitive than MMSE.

Keywords: Schizophrenia, Cognitive impairment, MoCA, MMSE

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1. Introduction

Schizophrenia is a complex neurodevelopmental disorder and cognitive deficits are considered to be central to the pathophysiology. A growing number of studies show that 75% of schizophrenia patients have a significant cognitive impairment (O'Carrol, 2000; Fisekovic et al., 2012).

Neurodevelopmental model of schizophrenia suggests that cognitive deficits often precede symptoms of psychosis, are stable over time and are only affected by pharmacologic treatment for symptoms (Kurtz MM et al., 2009). Some studies confirmed that cognitive deficits have been shown to correlate with social and functional symptoms (Green et al., 2000; Fisekovic et al., 2012). Cognitive impairment seems to be more related to negative symptoms. For these reasons, cognitive dysfunction is thought to be a primary disorder and also independent of the other psychopathological symptoms (Soygür et al., 2007).

Cognitive functions are affected, particularly executive functions, attention, perceptual/motor processing, vigilance, verbal learning and memory, verbal and spatial working memory and verbal fluency (Fisekovic et al., 2012; Preda et al., 2011). Cognitive dysfunction may indicate the interplay in the fields including the cortico-cerebellar-thalamic-cortical loops. While memory dysfunctions indicate the loss of temporal-hyppocampal functions, executive dysfunctions are associated with the prefrontal cortex in schizophrenia (Soygür et al., 2007). The Prefrontal cortex integrates information directly from the limbic regions, neocortex, brainstem and hypothalamus and indirectly via the thalamus from all regions of the brain. Dysfunctional changes in this part of central nervous system cause disorders of consciousness, planning, concentration, speech, vision, emotion and affect (Lencz et al., 2006).

Schizophrenia is a chronic psychiatric disorder that leads to a high degree of impairment in social, occupational and educational functioning. Over the last two decades, abundant evidence has shown that even first-episode schizophrenia patients -yet not exposed to the effects of antipsychotic drugs- show 1-2 standard deviation impairments on a variety of measures of neurocognitive function including language, attention, episodic and working memory and problem-solving relative to healthy matched controls (Green et al., 2000; Kurtz et al. 2009; Fisekovic et al., 2012;). Reviews suggest that neurocognitive impairments explain 20-60% of the

variance in studies of interpersonal problem-solving abilities, social and occupational functioning and measures of skill acquisition in rehabilitation programs (Fisekovic et al., 2012; Green et al., 2000). Studies suggest that cognitive functioning is the best single predictor of the need for patients to be admitted to the clinic with patients who are examined as well as an emergency case, even better than the diagnosis which is set. Cognitive evaluation facilitates the differential diagnosis and also has significant clinical relevance (Green et al., 2000; Nasreddine et al., 2005; Lencz et al., 2006).

Because the MoCA assesses multiple cognitive domains, it may be a practical cognitive screening tool for psychiatric disorders. In the present study, we compared the Montreal Cognitive Assessment (MoCA), a useful, validated, brief instrument for the detection of mild cognitive impairment (MCI) with the Mini-Mental State Examination (MMSE) as a screening test for cognitive deficits in schizophrenia.

The first aim of the current study was to evaluate and compare the degree of cognitive dysfunction in patients diagnosed with schizophrenia using MoCA and the MMSE alone. The second aim of the study was to compare the psychometric properties and the degree of sensitivity of these two instruments. The third aim of this study was to compare the characteristics of applications that may be appropriate for the clinical utility of these tools.

2. Methods

2.1. Subjects

A group of thirty-one inpatients meeting DSM-IV (APA., 1994) criteria for Schizophrenia as determined by the Structured Clinical Interview for DSM-IV was recruited for the study at the Psychiatry Clinic. Exclusion criteria for patients included auditory or visual impairment, evidence of mental retardation as indicated by history, presence of history of any neurological disorders, traumatic brain injury with a sustained loss of consciousness and/or criteria met for concurrent substance abuse or dependence. The study was conducted as a descriptive controlled study. All patients were treated with atypical antipsychotics (risperidone, olanzapine, quetiapine and clozapine). All study procedures met with institutional ethical approval. Patients who agreed to take part in the study gave written informed consent. Demographic and clinical characteristics of the sample are presented in Table 1.

2.2. Instruments

We used Montreal Cognitive Assessment Test (MoCA) and Mini Mental State Examination (MMSE) for the assessment of cognitive impairments. Neurocognitive testing and scoring were administered by the same member of research team.

The Montreal Cognitive Assessment Test Turkish version (MoCA-TR) as it appears on the official website (www.mocatest.org) was translated, and it contained certain cultural and linguistic changes from the original version presented in 2009 by Selekler et al. (2010) and it has been validated in AD in Türkiye. The MoCA is more sensitive to subtle cognitive deficits in patients with Parkinson's disease compared with the conventional MMSE. The MoCA is a 10-min test that briefly evaluates the following seven cognitive domains on one page: visuospatial and executive functions: alternating trail making (1 point), cube copying (1 point), clock drawing (3 points), naming: (lion, rhinoceros, camel) (3 points), attention: forward and backward digit span (2 points), tapping to the letter A (1 point), subtraction from 100 by 7s (1 point); language: sentence repetition (2 points), letter fluency (1 point); abstraction: similarities between train and bicycle, watch and ruler (2 points); memory: 5-min delayed verbal recall of five words (5 points); and orientation to time and place (6 points). As two MoCA tasks (subtracting by 7s and orientation questions) overlapped with identical items on the MMSE, these items were tested only once. To correct for educational effects found in the original study, an additional 1 point was given to subjects with 12 or fewer years of education, following the author's instructions and the procedure adopted in previous studies. The scores on the MoCA-TR ranged from 0 to 30, with higher scores indicating better cognition and scores below 21 indicating cognitive impairment in the Turkish AD population (Selekler et al., 2010, Ozdilek et al., 2013).

Table 1. Sociodemographic and clinical characteristics

Variables	Descriptive
	Patients (n=31)
Age (Mean±SD)	41.00±10,57 (Min: 20, Max: 67)
Sex (n, %)	
Male	6 (19,4)
Female	25 (80.6)
Education (year), (Mean±SD)	9.03±3.98
Disease duration (year), (Mean±SD)	9.86±8.22
Age at onset of disease (Mean±SD)	31.09±8.42 (Min: 17, Max: 57)

The Mini Mental State Examination Turkish version (MMSE-TR), which has been validated in the Turkish population, includes items for orientation to time and place (10 points), registration (immediate verbal recall of three words), serial subtraction (from 100 by 7s), memory (delayed verbal recall of three words), naming (pencil, watch), language (repeat a phrase, follow written instruction, follow a 3-step command, write a sentence), and drawing (copy a line drawing of overlapping pentagons). The scores ranged from 0 to 30, with higher scores indicating better cognition, and scores below 24 indicating cognitive impairment (Gungen et al., 2002). The MMSE is the most commonly used screening tool to

detect cognitive dysfunction in patients diagnosed with schizophrenia.

We used Positive and Negative Syndrome Scale (PANSS) for the assessment of positive, and negative symptoms and general psychopathology (Kay et al., 1986). Positive and Negative Syndrome Scale (PANSS), which has been validated in schizophrenia in Türkiye (Kostakoğlu et al., 1999), includes 7 items for positive symptoms, 7 items for negative symptoms and 16 items for the assessment of general psychopathology.

2.3. Statistical Analyses

To test the statistical significance of observed differences between groups used a one-way analysis of variance (ANOVA), while testing the interconnection of the observed variables used Spearman's correlation coefficient, with p value of under 0.05 is considered to be statistically significant.

3. Results

Thirty-one patients diagnosed with schizophrenia were included in this current study. Mean age of disease onset was 31.09±8.42 (Mean±SD) and the age of onset of disease ranged from 17-57 years. This result may have resulted from the majority of the patients in the sample were women. Demographic data (Table 1) showed that duration of the disorder was 9.86 ± 8.22 (Mean ± SD) in years. As shown in Table 2, mean score on the MoCA scale was 17.54±4.80, corresponding to moderate to severe cognitive impairment, while mean score on the MMSE was 23.48±3.65, corresponding to the result of mild cognitive impairment. Mean duration of test time on MoCA scale was 10.19±3.74 in accordance with general population. Figure 1 shows the MoCA and MMSE scale scores of patients.

17 patients (54.8%) of those who were on MMSE scale had a score greater or equal to 24 (normal range) and the MoCA scale had a normal score (>21), while 11 (35.5%) patients reported moderate to severe cognitive impairment (Table 3). MoCA scores did not significantly correlate with PANSS total or general, positive and negative symptoms subscores. Analysis of the correlation coefficient between the total score of MoCA and MMSE scale indicates a statistically significant positive correlation with Spearman rho=0.81 and P<0.001.

Table 2. Clinical scale scores of the patients (n=31)

Variables			
MoCA score (Mean±SD)	MoCA test period (Mean±SD)	MMSE score (Mean±SD)	PANNS score (Mean±SD)
17.54±4.80	10.19±3.74	23.48±3.65	99.20±22.48

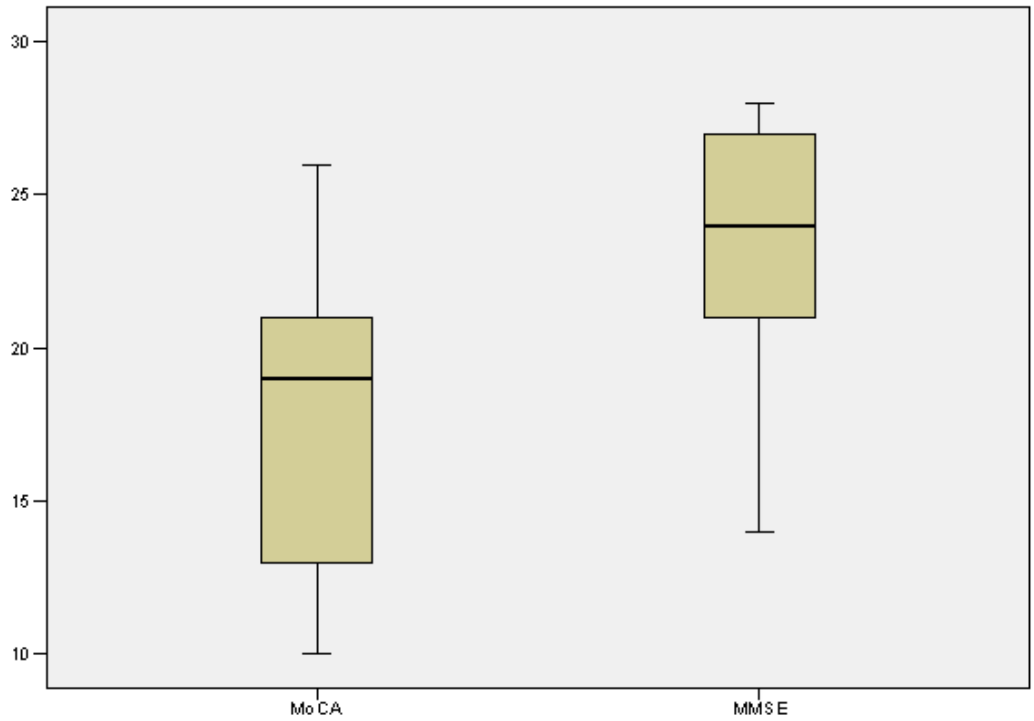

Figure 1. Montreal Cognitive Assessment (MoCA) and Mini-Mental State Examination (MMSE) scores of patients

Table 3. Comparison of cognitive impairment according to scales

	Patients (n=31)	Statistics	
		X^2	P
Cognitive impairment according to the MoCA scale			
< 21	20 (64.5)		
≥ 21	11 (35.5)	8,95	P<0.003*
Cognitive impairment according to the MMSE scale			
< 24	14 (45.2)		
≥ 24	17 (54.8)		

4. Discussion

The clinical value of a screening tool is directly related to either considering cognitive impairment a key aspect of schizophrenic psychopathology and, according to the proposed DSM-V revisions, recommending it as one key dimension to be measured in all patients with a psychotic disorder, or including cognitive deficit as one of the diagnostic criteria for psychoses as suggested by some authors (Lewis, 2004; Keefe et al., 2007; Smith, et al., 2007). The practical utility of the administered tests should not be forgotten when conducting a neuropsychological assessment, and since there is a large number of psychiatric patients (accounting for around 2% of the general population) who require diagnosis, there is a growing need for cost-effective and highly efficient diagnostic tools (Green et al., 2000; Preda et al., 2011; Fisekovic et al., 2012).

In this regard the present study investigates the clinical usability of the Montreal Cognitive Assessment (MoCA) as a screening tool for cognitive impairment in schizophrenic patients alone, and in correlation with the Mini-Mental State Examination (MMSE). Previous studies have shown that the Montreal Cognitive Assessment (MoCA) takes approximately 15 minutes to administer, compared to a mean of around 75 minutes for the administration of a full neuropsychological battery and it has good validity and reliability (Selekler et al., 2010; Ozdilek et al., 2013).

In this study all patients (n=31) were applied MoCA and MMSE scales. The mean MoCA score was consistent with moderate to severe cognitive impairment. Mean score on the MoCA scale was 17.54±4.80 (≥ 21 normal range in Turkish population), corresponding to moderate to severe cognitive impairment, while scores on MMSE scale was 23.48±3.65 (≥ 24 normal range in Turkish population), which is normal to mild cognitive impairment (MCI) cognition score range. These findings are consistent with the results of Preda et al. (2011) for both MoCA and MMSE scales which state the mean MoCA score was 20±4.7 and the mean MMSE score was 27.2±2. According to the research of Preda et al. (2011) 14 patients (77.8%) of those who on the MMSE scale had a score ≥ 26 (normal range) also on MoCA scale had a normal score (> 24), while in 2 or 22.2% of patients was reported moderate to severe cognitive disability. These findings are in contrast with the findings of Preda et al. (2011), where twenty-one patients (84%) of those who scored ≥ 26 (normal range) on the MMSE had a MoCA score < 26 (MCI range). Twenty-three (85%) of those who scored ≥ 24 on the MMSE (MCI range) had a MoCA score < 24 (moderate to severe cognitive impairment).

MoCA scores did not significantly correlate with any PANSS total or subscores. This result supports the view that cognitive deficits might be an independent schizophrenia symptoms domain.

Analysis of the correlation coefficient between the total score of MoCA and the MMSE scale indicates a statistically significant positive correlation with Pearson Spearman (rho=0.81 and P<0.001) (P<0.05), but this study did not analyze individual subscales as stated in research by Preda et al. (2011) and it is difficult to compare with their findings. The MoCA test validation study has shown the MoCA to be a promising tool for detecting Mild Cognitive Impairment (MCI) compared with the well-known Mini-Mental State Examination (MMSE).

During the past few years, an approach that ensures the construct validity of cognitive assessment of various researchers has suggested a recent exploration of the proposal to apply a generalized deficit in order to determine whether multiple performance deficits in schizophrenia are the result of common underlying processes (Lewis, 2004; Preda et al., 2011; Fisekovic et al., 2012).

5. Conclusion

There is considerable difficulty in comparison of reliably assessment scales. To date, there are no validated brief screening instruments for the diagnosis and assessment of severity of schizophrenia cognitive deficits. The MoCA has higher sensitivity and specificity to detect cognitive impairment than the MMSE. The MoCA is an easy to administer useful screening tool for the assessment of cognitive deficits associated with schizophrenia.

The results of the present study also suggest that the MoCA might be a sensitive test for the assessment of some of the core cognitive deficits in schizophrenia such as speeded attention and executive functioning. Further studies validating MoCA against standard neurocognitive testing batteries are recommended However, it had been established that the MMSE is not well suited for mild cognitive impairment, which raises the question of whether it is an adequate standard to compare performance with the MoCA.

Author Contributions

All task made by S.Z. (100%); Concept, Design, Supervision, Data collection and/or processing, Data analysis and/or interpretation, Literature search, Writing, Critical review, Submission and revision. The author reviewed and approved final version of the manuscript.

Conflict of Interest

The author declared that there is no conflict of interest.

Ethical Approval/Informed Consent

Our research was carried out in accordance with the Declaration of Helsinki of the World Medical Association. Written consent was obtained from the patients who participated in this study. The dignity of respondent was secured by giving right to reject or discontinue from the research study at any time. The respondent's anonymity was maintained during data collection by giving code number instead of name, and confidentiality of the information was maintained by not disclosing the information to others.

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