

MOCA- A SCREENING ASSESSING COGNITION IN INDIVIDUALS BETWEEN 50-60 YEARS

Medical Science

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ABSTRACT

The Montreal Cognitive Assessment (MoCA) is a widely used screening tool designed to detect cognitive impairments in individuals. Developed in 1996 by Ziad Nasreddine in Montreal, the MoCA is a 30-point test administered over approximately 10 minutes and is available in 46 languages. While it has been validated across multiple cultural settings, not all versions have undergone validation, and no normative data currently exist for the Indian population. This study aims to establish normative data for MoCA scores in a North Indian population aged 50-60 years. A total of 100 healthy participants, including 50 males and 50 females, were administered the MoCA, and their scores were analyzed. A score of 26 or higher was considered normal. This research provides foundational data for the use of MoCA in assessing cognitive function in North Indian adults.

KEYWORDS

MoCA, Cognitive Impairment, North Indian Population, Cognitive Assessment, Normative Data

INTRODUCTION

A driver needs to meet the following physical and mental requirements like nonexistence of fatigue, physical ability that is required to operate a vehicle nonexistence of a health condition that can cause a driver to lose control or become immobilize during driving. The sensory function requirements are intact visual, intact hearing, sense of touch. The mental requirements include ability to process the sensory functions, ability to focus, being stable mentally and emotionally, ability to make sound judgment that is required while driving and ability to identify a driving hazard, process it, and make a sound decision and react appropriately to each situation. Hence the most important component involved in driving is cognition (Drivers Education, Inc.).

Occupational therapy practitioners are increasingly being called on to screen and evaluate fitness to drive of people who are potentially at higher risk for accidents (e.g., older drivers) and to conduct driving retraining for people with a wide range of physical or cognitive impairments or disabilities that affect safe driving (AOTA, 2005).

Driver rehabilitation and training have become an emerging practice area for occupational therapy practitioners (Gourley, 2002). Many cognitive assessments are available for evaluating the process of cognition, few of them are MoCA- Montreal Cognitive Assessment, MMSE- Mini Mental Status Examination, MVPT- Motor Visual Perceptual Test, MSE- Mental Status Examination etc.

MoCA- Montreal Cognitive Assessment is a screening tool for detecting cognitive impairment in individuals. It was developed in 1996 by Ziad Nasreddine in Montreal, Quebec. It was validated in the setting of mild cognitive impairment, and has subsequently been adopted in numerous other settings clinically. It is a one page 30-point test administered in approximately 10 min and is available in 46 languages and dialects. Multiple cultural and linguistic variables may affect the norms of the MoCA across different countries. However, not all versions have been validated.

It may be a useful cognitive screening tool for several neurological diseases that affect younger populations, such as Parkinson's disease,^{[12][13][14]} vascular cognitive impairment,^{[15][16]} Huntington's disease,^[17] brain metastasis, sleep behaviour disorder,^[18] primary brain tumors (including high and low grade gliomas),^[19] multiple sclerosis and other conditions such as traumatic brain injury, depression, schizophrenia^[20] and heart failure. The test is also used in hospitals to determine whether patients should be allowed to live alone or with a home aide.

Gila Albert et al (2018) in their article titled "The challenge of safe driving among elderly drivers published online in Healthcare Technology letters discussed the challenge of ageing with regard to driving. They aimed to point out the complexity of elderly driving and to suggest counter-measures by acknowledging that obtaining the

correct balance between safety and mobility of older drivers is a complicated and sensitive task.

Carrie Gibbons et al (2017) in their study titled "Using Serial Trichotomization with Common Cognitive Tests to Screen for Fitness to Drive" published online in the AJOT, 7102260010 aimed to illustrate the use of Serial Trichotomization with five common tests of cognition to achieve greater precision in screening for fitness to drive. Data was collected using the MOCA, MVPT, clock drawing test, Trail Making Test (Part 'A' & 'B') and an On-road Driving Test from 83 persons referred for driving evaluation.

There is a growing need for quick and effective cognitive screening measures. The Montreal Cognitive Assessment (MoCA; Nasreddine et al., 2005) was developed as an alternative to the popular Mini-Mental State Examination (MMSE; Folstein, Folstein & McHugh, 1975) has shown improved sensitivity to mild cognitive impairment (MCI; Markwick, Zamboni, & de Jager, 2012; Smith, Gildeh, & Holmes, 2007). Although the MMSE and MoCA are relatively brief (10;15 minutes administration time), their use in routine healthcare visits may still be limited due to time constraints (Iliffe et al., 2009; Tangelos et al., 1996). Therefore, many clinicians have a limited ability to quickly screen for cognitive impairment and may have difficulty determining when to refer for further evaluation when cognitive concerns are raised. MoCA test better meets the criteria for screening tests for the detection of MCI among patients over 60 years of age than MMSE.

Till date no normative data is available for the MoCA test in Indian Population, hence an attempt was made in this study to collect normative data for MoCA in North Indian population between the age group of 50-60 years.

Aim of the Study

The study aims to collect normative data for MoCA for assessing cognitive skills in healthy population between the age group of 50-60 years.

Methodology

MoCA- Montreal Cognitive Assessment is a one page 30 point test administered in approximately 10 min. The test was developed in 1996 by Ziad Nasreddine in Montreal, Quebec. It was validated in the setting of mild cognitive impairment.

Cognitive Domains assessed by the MoCA
Visuospatial/Executive
Modified Trail Making Test

Beside visuomotor and visuosperceptual skills, the trail making test-B (TMT-B) requires mental flexibility to shift between numbers and letters which mainly rely on frontal lobe function (2-5).

Copy of the Cube

To copy a cube, subjects have to initially convert a two-dimensional contour to a three-dimensional cube. This ability is enhanced by learning experiences(12,13). After spatial planning, visuomotor coordination also plays a role in copying the cube. Various brain areas are involved; visual perception in the parieto-occipital lobe, planning in the frontal lobe, and integration of visual and fine motor sequences in the fronto-parieto-occipital cortices.

The cognitive mechanisms underlying performance in copying a figure are different according to the underlying disease.

The Clock Drawing Test

The Clock Drawing Test (CDT) has been widely used and studied for detection of dementia and mild cognitive impairment. Planning, conceptualization, and symbolic representation are involved in drawing a clock's face and in placing all the numbers correctly (18,19). Inhibitory response is required when placing each hand to tell the time of "ten past eleven". Self-initiated-clock-drawing also requires intact visuoconstructive skills which are mainly represented in the parietal lobe.

The three animals in the MoCA (Lion, Rhinoceros and Camel) are infrequently seen in Western and even in Asian countries. The failure to name these animals may point to various types of cognitive impairment. If subjects cannot name but can give contextual information about the animal, for example, "It lives in the desert (Camel)", this could suggest either word finding difficulty or semantic memory impairment. If subjects cannot tell both the name and the context, they may have impaired visuo-perceptual skills with inability to recognize the animal (failure in the cube copy and the CDT can support this possibility). They may also be impaired in both visuo-perception and semantic memory such as in moderate to severe AD or advanced PD with dementia. Low education or cultural exposition to such animals can also be responsible.

Attention

The Digit Span

Digit Span Forward (DSF) measures retention of auditory stimuli and articulatory rehearsal. Digit span backward (DSB) requires transient working memory, and more demanding ability in transforming digits into a reversed order before articulating. This extra-step requires central executive processing (41).

Concentration and Calculation

Letter A tapping test

Concentration, which is defined as sustained and focused attention, is the primary function required for proper identification of letter A and inhibition of inappropriate non-letter A tapping. It has good sensitivity to cognitive impairment in mild traumatic brain injury and persistent post-concussion syndrome (51,52). Speed of response to externally-paced stimuli accounts for this test's sensitivity (52).

Language

Sentence Repetition

Sentence repetition assesses language skills which are supported by left temporo-parietal-frontal circuit. Repeating complex sentences also requires attention and concentration to memorize the words which are supported by working memory systems in the frontal lobes (61).

Letter F fluency

Verbal fluency is divided into phonemic (letter) and semantic (category) fluency. Letter F fluency in the MoCA mainly depends on frontal lobe function compared with semantic fluency, which is sustained by both temporal and frontal lobes. Letter F fluency requires coordination of lexicosemantic knowledge, shifting from word to word, working memory, searching strategy and inhibition of irrelevant words which all highly depend on frontal lobe function and to a lesser extent the temporal lobe.

Abstraction

Similarity between objects requires semantic knowledge and conceptual thinking. In right-handed subjects, the left perisylvian glucose metabolism was closely associated with performance on the Wechsler Similarities Test (WST) (57).

Delayed recall

More words to recall (5 versus 3), less learning trials (2 versus up to 6),

and more time between immediate recall and delayed recall (5 minutes versus 2 minutes) probably explains MoCA's superior sensitivity for amnesic MCI detection compared to the MMSE.

Orientation

Impairment in orientation has been shown to be the single best independent predictor of daily functions in patients with dementia, and is also associated with caregiver burden and psychological distress (108,109).

100 normal healthy individuals (50 male and 50 female) were taken up for the study. The individuals were briefed about the study and they gave their informed consent for the study. The individuals were all office goers with fair amount of cognitive performance. Individuals with any underlying medical conditions were excluded from the study.

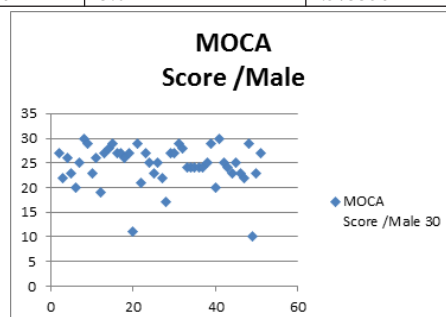
MoCA was administered to them and the scores obtained by each of them were recorded and analysed using the average scores and standard deviation. The individuals were taken to a calm environment where there were no stressors so that they perform optimally in the test without any external influence or disturbance.

DATA ANALYSIS AND RESULTS

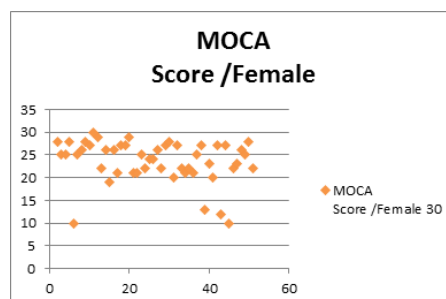
The Data was collected, and the mean and standard deviation was found out. The average score (mean) among normal healthy female individuals was found to be 23.62 and the standard deviation was 4.57. The average score mean among normal healthy male individuals was found to be 24.54 and the standard deviation was 4.09 as illustrated in Table 1. Graph 1 shows the schematic representation of the mean scores of males and Graph 2 shows the schematic representations of the mean score of females.

Table 1:

Category	Mean	Std. Dev
Male	24.54	4.090037
Female	23.62	4.573358



Graph 1:



Graph 2:

Further the number of females and males across the different age groups (Table 2) and their average scores (Table 3) was also calculated and tabulated below. There were 23 normal females in the age group of 50-54 and 27 normal females in the 55-59 age group, and there were 25 normal males in both the 50-54 and 55-59 age groups. Their average scores have also been calculated and given in table 4.

Table 2: Number of females and males in the different age groups

Category	50	51	52	53	54	55	56	57	58	59
Females	5	5	6	6	1	9	3	2	7	6
Males	4	5	5	4	7	7	6	6	4	2

Table 3: Average score of MoCA across various age groups in females and males

Category	50	51	52	53	54	55	56	57	58	59
Females	23.2	27.2	23.8	25	22	24.4	21.3	26	18.8	24.3
Males	24.5	25.4	25.8	26.75	23	24.85	25	24.5	21	25

Table 4:

Age Groups	Females		Males	Avg.score	
				Females	Females
50-54	23		25	24.24	25.09
55-59	27		25	22.96	24.07

DISCUSSION

The major outcome of the study is to find out the average MOCA score and standard deviation in both normal male and female between the 50-60 age group. The average score ie the mean in normal healthy females is 23.62 whereas for the male population it is 24.54. This when compared with other results done for MOCA might fall under the category of mild cognitive MoCA scores range between 0 and 30.^[11] A score of 26 or over is considered to be normal. In a study, people without cognitive impairment scored an average of 27.4; people with mild cognitive impairment (MCI) scored an average of 22.1; people with Alzheimer's disease scored an average of 16.2.^[11]

From the results calculated it can be found that there was only one participant in the 54-year age group in the female group, 2 participants each in the 57 age group in the female group and 59 age group of the male individuals and 3 participants in the 56 age group of females.

It was also found that 1 female scored the maximum, 20 females scored between 26 & 29, 24 scored between 20 & 25, 3 scored between 11 & 19 and 2 scored 10. It has been also found that there is a gradual decrease in the scoring as the age progresses which may be attributed to the fact of decreased cognitive functioning as evident from table 4.

It was also found that 2 males scored the maximum, 20 males scored between 26 & 29, 24 scored between 20 & 25, 3 scored between 11 & 19 and 1 scored 10. It has been also found that there is a gradual decrease in the scoring as the age progresses which may be attributed to the fact of decreased cognitive functioning as the age increases as evident from table 4.

One more explanation can also be attributed to MoCA being an English specific, linguistic and cultural translations are made to adapt the test in other countries but has not been done in this study. Multiple cultural and linguistic variables may affect the norms of the MoCA across different countries and languages e.g. Swedish.^[3] Several cut-off scores have been suggested across different languages to compensate for education level of the population, and several modifications were also necessary to accommodate certain linguistic and cultural differences across different languages/countries. However, not all versions have been validated.

The MoCA is validated for use in 55–85-year-olds. The original study was carried out on 90 controls, 94 patients with MCI and 93 patients with Alzheimer's Disease [3]. Their average scores were 27.4, 22.1 and 16.2, respectively. The MoCA has been validated in many conditions including MCI, Alzheimer's disease and Parkinson's Disease dementia [3–5]. The MoCA has been found to be superior to the Mini-Mental State Examination (MMSE) as a global assessment tool, particularly in discerning earlier stages of cognitive decline [6]. A review comparing different brief assessment tools for cognitive impairment listed the MoCA's disadvantages as lacking studies in general practice settings, an education bias (12 years), limited use and evidence due to published data being relatively new (2005) and an administration time of over 10min [7]. The MoCA has been recommended by the National Institutes of Health and the Canadian Stroke Consortium for detection of vascular cognitive impairment and the Canadian Consensus Guidelines for Diagnosis and Treatment of Dementia for detection of Mild Cognitive Impairment and Alzheimer's disease [8]. In the UK, the Alzheimer's Society recommends that the MoCA should be used for cognitive assessment in memory clinics and for outpatient specialist assessment [9].

The website lists over 70 English language references regarding the use of the MoCA in Alzheimer's Disease and MCI. There are also similar lists of references for its use in a wide range of other conditions including vascular dementia and Parkinson's Disease. There was no

research found validating the MoCA in an occupational health setting. The MoCA has been used to assess cognitive decline in manganese workers [10].

This screen targets several categories—visuospatial/executive functions, naming, memory, attention, language, abstraction, delayed recall, orientation—each of which is independently scored and combined for a total possible score of 30. Advantages of the MoCA include its sensitivity as a screening tool for mild cognitive impairment, Alzheimer's disease, and dementia, as well as its ease of use.

Hence the study provides normative data for MoCA among the North Indian population in the 50-60 age group.

CONCLUSION

The findings of this study provide important insights into the cognitive performance of North Indian males and females aged 50-60, as measured by the Montreal Cognitive Assessment (MoCA). The average MoCA scores for females (23.62) and males (24.54) fall within the range of mild cognitive impairment (MCI), as scores below 26 are generally considered indicative of cognitive decline. These findings align with previous research that suggests a gradual decrease in cognitive function with age, a trend evident in both male and female participants. The study also highlights that while most participants scored between 20 and 29, a small number showed more severe cognitive impairment, scoring below 20. This further emphasizes the variation in cognitive abilities within the studied age group. Additionally, the study notes the potential influence of cultural and linguistic factors on MoCA scores, as the test has not been culturally adapted for the North Indian population, which may impact the results. Overall, the research adds valuable normative data for the use of MoCA in a North Indian context, particularly for individuals between 50-60 years of age. These results can help inform future studies and aid in early detection of cognitive decline, with the MoCA continuing to be an important tool for assessing mild cognitive impairment and early stages of dementia.

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