Supplementary Material

Curve Walking Reveals More Gait Impairments in Older Adults with Mild Cognitive Impairment than Straight Walking: A Kinect Camera-Based Study

DIAGNOSIS OF MCI

The identification of mild cognitive impairment (MCI) was conducted using a multi-step diagnostic procedure aligned with standard clinical protocols, as outlined in the literature [1-5]. Initially, cognitive decline was assessed by qualified neuropsychologists at the IDAA center, employing the Mini-Mental State Examination (MMSE) and the Montreal Cognitive Assessment (MoCA). To account for educational differences, two distinct Persian versions of these tests were administered based on the participant's education level.

Furthermore, to exclude the influence of depression on cognitive assessments, participants were evaluated using the Persian version of the Geriatric Depression Scale (GDS). The threshold scores for the detection of MCI were set at ≤26 for the MMSE and ≤22 for the MoCA, following the benchmarks established by previous research [6].

Participants with scores indicating potential cognitive impairment were subjected to an in-depth neuropsychological evaluation. This included interviews with patients and their relatives or caregivers, an extensive review of medical history and current medications, a physical examination, and laboratory tests. Neuroimaging, such as MRI or EEG, was considered when deemed necessary by consulting neurologists.

Functional status assessment was performed using the Instrumental Activities of Daily Living (IADL) and Activities of Daily Living (ADL) scales, with a cutoff score of ≤6 to differentiate MCI individuals from healthy controls [1]. Neuroimaging data, including indicators of brain atrophy and white matter lesions, were utilized by neurologists to aid in the MCI diagnosis [7,8]. Additionally, blood tests were conducted to identify conditions such as vitamin B-12 deficiency or thyroid dysfunction that might affect memory and cognition [9].

STUDY OF RELATIONSHIP BETWEEN NEUROPSYCHOLOGICAL SCORES AND GAIT MARKERS

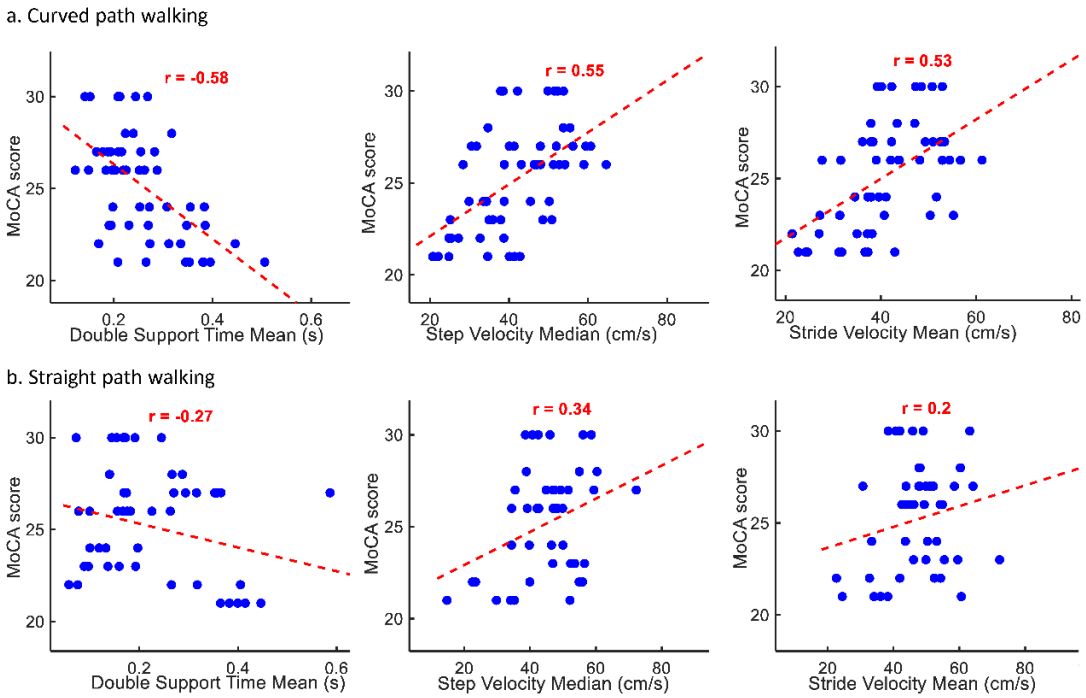
To study the relationship between MoCA scores and gait markers, we have conducted a detailed analysis including plotting the scatter plots of neuropsychological scores for MMSE,

MoCA, and GDS versus extracted gait markers, and the correlation analysis was done. Supplementary Figure 1 illustrates the scatter plots for the three gait markers that demonstrated the most substantial correlations with MoCA scores during both straight and curved path walking.

The scatter plots reveal distinct distribution patterns for the various gait markers relative to MoCA scores. The correlation coefficients vary considerably, ranging from 0.04 to 0.58, indicating a spectrum of associations between cognitive function as assessed by MoCA and gait parameters. This variability suggests that while there is a correlation, the relationship is not uniformly strong across all markers.

Further comparison of correlation coefficients between gait markers and different neuropsychological assessments (MoCA, MMSE, and GDS) demonstrates a higher incidence of significant correlations with MoCA, especially during curved path walking. This finding suggests a more robust association between MoCA scores and gait impairment in MCI than with MMSE or GDS scores. Supplementary Table 1 summarizes the number of significant correlation coefficients for these neuropsychological scores in different gait test conditions.

For our analysis, a correlation was considered significant at a p-value < 0.05. The results from these analyses confirm that MoCA is a more sensitive tool than MMSE and GDS for assessing gait disturbances in MCI patients.



Supplementary Figure 1. Scatter plots of most significant correlated gait markers with MoCA scores

Supplementary Table 1. Number of Significant Correlation Coefficients for Various Neuropsychological Scores Versus Gait Markers Under Different Walking Conditions.

Gait test condition	Neuropsychological tests		
	MoCA	MMSE	GDS
Straight Path walking	N = 19	N = 17	N = 14
Curved path Walking	N = 23	N = 20	N = 11

MoCA, Montreal Cognitive Assessment; GDS, Geriatric Depression Scale; MMSE, Mini-Mental State Examination; N, Number of significant correlation coefficients.

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