



Introduction

- The clock drawing test (CDT) is a simple, routine screening neuropsychological test that involves a number of different cognitive functions including executive functioning, visuospatial skills, and working memory ¹
- Based on previous research studies, the CDT has been useful in distinguishing among many different neurodegenerative diseases such as Alzheimer's disease (AD), Parkinson's disease (PD), vascular dementia, frontotemporal dementia, and mild cognitive impairment (MCI) ¹
- The purpose of this study is to examine differences in CDT performance in individuals with AD and PD compared to normal controls

Methods

- A total of 194 participants were included in the analysis
- Majority of the sample were Caucasian/Non-Hispanic individuals (97.4%) and female (67%) with a mean age of 73 years and a mean education of 14 years
- All participants were administered a comprehensive battery of neuropsychological tests and completed the MMSE
- 4 total groups were included in the analysis
 - Mixed late MCI/mild AD
 - Moderate AD
 - PD with no cognitive impairment
 - Normal controls
- The groups were further organized based on their MMSE scores
 - Mixed late MCI/mild AD (MMSE > 24)
 - Moderate AD (MMSE ≤ 23)
 - All PD patients (MMSE score > 24)
 - All normal controls (MMSE score > 24)

Results

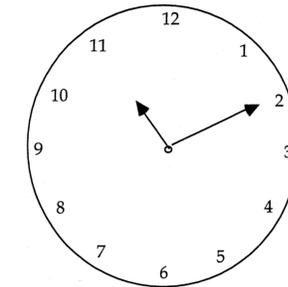
- An ANOVA was used to examine group differences in CDT and MMSE scores
- There was a significant main effect of group for both CDT and MMSE scores ($p < 0.001$)
- There was a significant difference between the groups for education ($p < 0.001$) and a statistical trend for age ($p = 0.06$)
- Moderate AD group had significantly higher error scores on the CDT compared to the control group ($p < 0.001$) and compared to both the mixed late MCI/mild AD and PD patient groups ($p < 0.001$)
- No statistical significance existed in the CDT error scores between the mixed late MCI/mild AD group compared to the control group ($p = 0.134$) or to the PD patient group ($p = 1.000$)
- No statistical significance existed in the CDT error scores between the PD group compared to the control group ($p = 0.904$) or to the mixed late MCI/mild AD patient group ($p = 1.000$)
- Findings suggest that executive functioning may only begin to significantly decline in more advanced stages of AD, but is well preserved in late MCI/mild AD and PD patients with no cognitive impairments

	PD	Mixed Late MCI/Mild AD	Moderate AD	Controls
Age	70.24 (±8.459)*	73.67 (±7.100)	73.80 (±10.206)	74.33 (±5.892)
Education	13.60 (±3.527)	13.60 (±3.212)	12.23 (±2.991)**	14.89 (±1.645)
CDT Error Scores	0.69 (±1.024)	0.82 (±0.984)	1.90 (±1.128) ***	0.41 (±0.687)
MMSE	26.98 (±2.484)	26.60 (±1.678)	19.40 (±2.716)****	28.22 (±1.538)

*Statistical trend for the PD group to be younger than the other 3 groups ($p = 0.06$)
 **Moderate AD group had significantly less years of education compared to the other 3 groups ($p < 0.001$)
 ***Moderate AD group had significantly higher error scores on CDT compared to the other 3 groups ($p < 0.001$)
 ****Moderate AD group had significantly lower MMSE scores compared to the other 3 groups ($p < 0.001$)

Clock Drawing Test Sample

Instructions: Draw a **CLOCK** at ten past eleven



Scoring:

- Outline of clock
- Numbers placed correctly
- Hour hand smaller than minute hand
- Hands correctly placed on 10 after 11

Discussion

- Our results are consistent with previous studies examining the usefulness of the CDT in measuring cognitive impairment in various neurodegenerative conditions ¹
- Our findings suggest that deficit in executive functioning measured by the CDT is impaired in advanced stages of AD, but relatively preserved in early stages of AD and PD with no cognitive impairment
- Limitations of this study was not including a copy trial for the CDT, which would have provided more support that the present findings are more exclusively due to executive dysfunction rather than a deficit in visuospatial skills
- Future directions include increasing the sample size of all groups, using a larger scoring system (ex. Rouleau 10 point scoring system), including PD patients with cognitive impairment, and using novel digital versions of the CDT to differentiate variables such as time to start and complete, visuospatial coordination, and graphic size

References

¹Freedman M, Leach L, Kaplan E, Winocur G, Shulman KI, Delis DC. *Clock Drawing: A Neuropsychological Analysis*. New York, NY: Oxford University Press; 1994.