# Qualitative Analysis of Mini Mental State Examination Pentagon in Vascular Dementia and Alzheimer's Disease: A Longitudinal Explorative Study

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*Background:* Vascular dementia and Alzheimer's disease are the most diffuse forms of dementia. Sometimes, they are difficult to distinguish due to overlaps in symptomatology, pathophysiology, and comorbidity. Visual constructive apraxia is very common in dementia and impairment in these abilities can provide clinical information for differential diagnosis. *Materials and Methods:* All patients underwent Mini Mental State Examination (MMSE) at basal visit (T0) and after 1 year (T1). We analyzed differences in Qualitative Scoring Method for the Pentagon Copying Test and we explored the visual constructive apraxia evolution in these 2 types of dementia. *Results:* In intragroup analysis, we found a significant difference in each group between T0 and T1 in MMSE score ($P < .001$) and total qualitative scores ($P < .001$). In intergroup analysis, at T0, we found significance difference in total qualitative scores ($P < .001$), in numbers of angles ($P = .005$), in distance/intersection ($P < .001$), in closure/opening ($P = .01$), in rotation ($P < .001$), and in closing-in ($P < .001$). At T1, we found significance difference in total qualitative scores ($P < .001$), in particular, in numbers of angles ($P < .001$), in distance/intersection ($P < .001$), in closure/opening ($P < .001$), in rotation ($P < .001$), and in closing-in ($P < .001$). The total score showed the highest classification accuracy (.90, 95%CI = .81-0.96) in differentiating patients with Alzheimer's disease from patients with vascular dementia. The optimal threshold value was k = 5. with .84 (95%CI = .69-0.93) sensitivity and .81 (95%CI = .64-0.93) specificity. *Conclusion:* Patients with vascular dementia showed more accuracy errors and graphic difficulties than patients with Alzheimer's disease. Qualitative analysis of copy provided a sensitive measure of visual constructive abilities in differentiating dementias, underlining a particularly vulnerability of visuoconstructive functions in vascular dementia compared with Alzheimer's disease. **Key Words:** Visual constructive apraxia—vascular dementia—Alzheimer's disease—MMSE—Neuropsychological Evaluation.


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## Introduction

The World Health Organization[1] estimates that 35.6 million people are living with dementia. These data are likely to increase; it is expected that in 2050 this number will triple with around 115 million of people affected by dementia. Dementia is typically defined as a clinical syndrome of cognitive decline that interferes with daily, social, or occupational functioning.[2,3] Alzheimer's disease (AD) and vascular dementia (VD) are the most diffuse types of dementia,[4] followed by mixed dementia, dementia with Lewy bodies, and frontotemporal dementia. Other causes of dementia include alcohol abuse, HIV/AIDS, certain vitamin deficiencies, brain tumors, Creutzfeldt–Jakob disease, Huntington's disease, and thyroid disease.

VD is induced by vascular abnormalities, such as decrease in cerebral blood flow, atherosclerosis, microbleeds,[5,6] or a stroke, and it is associated to cognitive impairment.[7] VD can develop gradually over time from the slowing of blood flow and it affects the white matter and basal ganglia bilaterally and diffusely. It is characterized commonly by psychomotor slowing and impairment in executive functioning, such as goal formation, initiation, planning, organizing, self-maintenance, sequencing, and abstraction.[8] The diagnostic criteria for VD require multiple cognitive deficits, focal neurological signs and symptoms, and laboratory evidence of cerebrovascular disease.[9]

In AD, the first changes affect the temporal lobe structures, specifically hippocampus and entorhinal cortex.[10] Disruption of the neural network damages episodic memory function and ability to learn and remember new information. AD in the early stages could be often confused with other dementia, especially with insidious forms onset of subcortical vascular dementia.[11,12] AD and VD, for example, could be characterized by the same initial symptoms: memory deficits and impairment of activities of daily living. Early and accurate differential diagnosis allows providing timely treatments that delay the progression of disease. Molecular neuroimaging techniques, such as magnetic resonance and positron emission tomography, play an important role in diagnostic workup for dementia.[13] In addition, the assessment of neuropsychological functions should be used for differential diagnosis of early-onset dementia. Neuropsychological assessment indeed permit to accurately detect the onset of cognitive changes that signal the beginning of a progressive dementia syndrome and to differentiate among disorders with distinct etiologies. Analysis of specific neuropsychological impairment, such as drawing disorder and apraxia, could provide clinical information for differential diagnosis.[14]

Early accurate diagnosis could be particularly difficult for the insidious onset and slow progression of most neurodegenerative diseases; however, it is critically important because lack of a reliable biological marker can distinguish AD from other neurodegenerative disorders.[15,16]

In this study, we investigated differences in Qualitative Scoring Method for the Pentagon Copying Test (QSPT)[17] in AD and VD and we explored the visual constructive apraxia evolution in these two types of dementia.

## Materials and Methods

One hundred patients (50 VD with average age of 71.14 ± 7.75 years, 50 AD with average age of 74.03 ± 7.71 years) were consecutively recruited and followed at our clinic for 2 years (Table 1). Patients were matched according to age and Mini Mental State Examination (MMSE) score.

All patients gave written consent to the study. The study protocol was approved by the Local Ethics Committee according to Declaration of Helsinki.

All patients underwent MMSE[18] at basal visit (T0) and after 1 year (T1). The MMSE is a practical method for grading the cognitive state of patients used for screening and monitoring the evolution of dementia. It allows

**Table 1.** *Socio-demographic and characteristics of AD and VD groups at T0 and T1*

| | AD | | VD | |
|---|---|---|---|---|
| | T0 | T1 | T0 | T1 |
| N. patients | 50 | 50 | 50 | 50 |
| Age (mean ± SD) | 74.03 ± 7.71 | 76.00 ± 7.70 | 71.14 ± 7.75 | 73.14 ± 7.74 |
| MMSE (mean ± SD) | 19.66 ± 3.68 | 17.72 ± 3.90 | 20.09 ± 3.13 | 17.84 ± 3.83 |
| Numbers of angles (mean ± SD) | 1.44 ± 1.16 | 1.44 ± 1.16 | .72 ± .73 | .35 ± .65 |
| Distance/intersection (mean ± SD) | 2.47 ± .95 | 2.38 ± 1.13 | 1.42 ± 1.16 | 1.00 ± 1.35 |
| Closure/opening (mean ± SD) | 1.03 ± .69 | .59 ± .67 | .65 ± .53 | .09 ± .29 |
| Rotation (mean ± SD) | 1.03 ± .59 | .72 ± .63 | .49 ± .51 | .19 ± .39 |
| Closing-in (mean ± SD) | 1.00 ± .00 | 1.00 ± .00 | .56 ± .50 | .70 ± .46 |
| Total qualitative score (mean ± SD) | 6.97 ± 1.80 | 6.13 ± 2.52 | 3.84 ± 1.56 | 2.35 ± 2.18 |

Abbreviations: AD, Alzheimer's disease; SD, standard deviation; VD, vascular dementia.