Do semantic clustering deficits underpin long-term memory binding impairments in

Clara Calia[1-2], Ellen Backhouse[2], Vivek Pattan[3], Robert Clafferty[4], John Starr[5], Sergio Della Sala[6], and Mario A Parra[1,5-7]

[1]School of Social Sciences, Department of Psychology, Heriot-Watt University, Edinburgh, UK; [2]Scottish Dementia Research Network, NHS Scotland, UK; [3]Stirling Community Hospital, Stirling, United Kingdom; [4]Royal Edinburgh Hospital, Edinburgh, United Kingdom; [5] Alzheimer Scotland Dementia Research Centre, Edinburgh, UK; [6]Human Cognitive Neuroscience and Centre for Cognitive Ageing and Cognitive Epidemiology, Department of Psychology, University of Edinburgh, UK; [7]Autnomous University of the Caribbean, Barranquilla, Colombia.

Background

The Free and Cued Selective Remind Test (FCSRT) was developed to measure the ability to bind semantic categories and exemplars and use such bindings as cues to access associative memory representations. However, the variable informing about such ability (i.e., sensitivity to cuing) does not fare better in the early detection of memory impairments in AD than variables measuring free recall. We investigated whether this is due to limited construct validity of the FCSRT. We used as a gold standard a well-known test of semantic clustering functions (i.e., Hopkins Verbal Learning Test - HVLT). We assessed patients with Mild Cognitive Impairment (MCI) due to Alzheimer's disease (AD) with both tests.

Hypotheses

Methods

Of 70 MCI patients who underwent two neuropsychological assessments a year apart, 12 converted to AD. We compared baseline performance of MCI converters and non-converters with that of healthy controls on the FCSRT, HVLT, and other traditional neuropsychological tests. We ran correlation analyses and tests of mean (ANOVA) to investigate if impaired semantic clustering functions, as measured by these tests, correlated in MCI patients and if MCI converters were more impaired at baseline than non-converters.

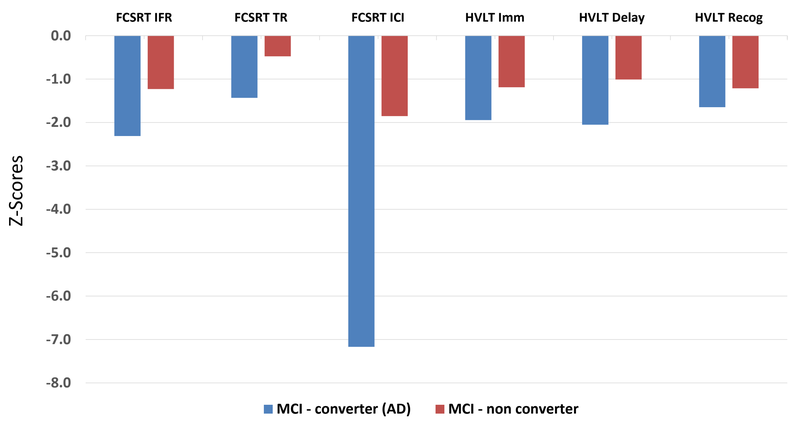
Table 1.

	Controls (N=72)		MCI - converter (AD) (n=12)		MCI - non converter (n=59)		ANOVA		Post-Hocs		
	Mean (SD)	Range	Mean (SD)	Range	Mean (SD)	Range	F	p	Ctr vs Conv	Crt vs No-Conv	Conv vs No-Conv
Age	75.01 (6.26)	(61.00-90.00)	77.42 (9.86)	(60.00-92.00)	75.75 (7.78)	(58.00-97.00)	0.61	0.543	0.060	1.000	1.000
Education	15.40 (4.12)	(9.00-33.00)	12.83 (2.76)	(10.00-19.00)	13.31 (4.23)	(9.00-25.00)	5.17	0.007	0.094	.12	1.000
MMSE	29.78 (6.83)	(25.00-86.00)	24.58 (2.84)	(19.00-28.00)	27.90 (8.54)	(22.00-90.00)	2.96	0.055	0.053	0.313	0.476
CDR	1.01 (5.29)	(0.00-30.00)	0.71 (1.25)	(0.00-4.50)	0.32 (0.69)	(0.00-5.00)	0.52	0.596	0.275	0.108	1.000
IADL	7.44 (1.14)	(4.00-8.00)	5.55 (1.29)	(4.00-8.00)	6.46 (1.75)	(1.00-8.00)	8.73	0.000	0.001	0.006	0.210
ACE	92.69 (10.29)	(26.00-100.00)	69.50 (9.89)	(54.00-91.00)	81.15 (10.68)	(28.00-99.00)	36.28	0.000	0.000	0.000	0.002
TMT B-A	55.57 (55.51)	(3.00-423.00)	174.60 (102.67)	(47.00-312.00)	105.39 (71.07)	(11.00-315.00)	18.93	0.000	0.000	0.000	0.008
Digit Span	6.64 (5.09)	(4.00-48.00)	5.09 (1.22)	(3.00-8.00)	5.45 (1.13)	(4.00-8.00)	2.01	0.138	0.422	0.152	1.000
Clock Drawing	4.83 (0.54)	(3.00-5.00)	3.50 (1.73)	(0.00-5.00)	4.46 (0.80)	(2.00-5.00)	14.62	0.000	0.000	.33	0.001
FAS	48.69 (14.28)	(15.00-81.00)	30.00 (12.06)	(14.00-53.00)	34.38 (15.55)	(6.00-74.00)	18.20	0.000	0.001	0.000	1.000

Table 2.

	Controls		MCI - converter (AD)		MCI - non converter		ANOVA		Post-hoc tests		
	Mean (SD)	Range	Mean (SD)	Range	Mean (SD)	Range	F	p	Ctr vs Conv	Crt vs No-Conv	Conv vs No-Conv
FCSRT IFR	25.28 (7.95)	(3.00-40.00)	6.90 (7.61)	(1.00-23.00)	15.51 (7.82)	(0.00-37.00)	39.58	0.000	0.000	0.000	0.000
FCSRT TR	16.28 (5.34)	(12.00-60.00)	8.64 (4.46)	(3.00-16.00)	13.75 (2.73)	(2.00-16.00)	16.67	0.000	0.000	0.004	0.002
FCSRT ICI	0.97 (0.08)	(0.56-1.00)	0.43 (0.34)	(0.07-1.00)	0.83 (0.19)	(0.34-1.00)	54.43	0.000	0.000	0.000	0.000
HVLT Imm	24.15 (6.38)	(6.00-35.00)	11.75 (5.46)	(5.00-23.00)	16.57 (5.42)	(7.00-32.00)	38.91	0.000	0.000	0.000	0.035
HVLT Delay	7.45 (3.47)	(0.00-12.00)	0.33 (1.15)	(0.00-4.00)	3.95 (3.98)	(0.00-17.00)	28.52	0.000	0.000	0.000	0.005
HVLT Recog	10.46 (2.00)	(4.00-12.00)	7.17 (2.29)	(4.00-11.00)	8.04 (3.02)	(0.00-12.00)	19.01	0.000	0.000	0.000	0.822

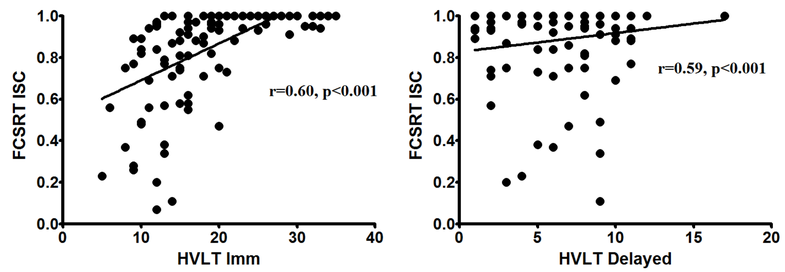
Figure 1.



Results

1. MCI patients were in advanced stages from baseline (i.e., multi-domain amnestic MCI).
2. Relative to controls, MCI converters and non-converters showed a similar level of impairment at baseline
3. Both groups showed significant impairments on all the variable from the FCSRT and the HVLT.
4. Such impairments were larger in MCI converter than in non-converter.
5. Sensitivity to cuing correlated with immediate and delayed recall variables form the HVLT.

Figure 2.



Conclusions

1. Semantic clustering abilities seem to underpin performance on the FCSRT.
2. MCI due AD will impairs semantic clustering abilities in the advanced prodromal stages
3. Future studies should investigate why semantic cuing, as assessed by the FSCRT, remains relatively preserved in the early stages of AD and the implications that this may have for the early detection of dementia.