

# Evaluation Of Retinal Thickness In Alzheimer's Disease



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## Introduction

Several studies have shown that degenerative changes occur in optic nerve fibers and manifest as thinning of **retinal nerve fiber layer (RNFL)** in patients with Alzheimer's disease (AD) and Mild Cognitive Impairment (MCI). It is plausible that these modifications may present in early stages of AD and may be the earliest sign of the disease, even prior to the hippocampal damage that impacts memory (1). The objective of this study is to assess whether retinal deterioration is an early biomarker of AD pathogenesis and to clarify the possible functional correlation with cognitive decline.

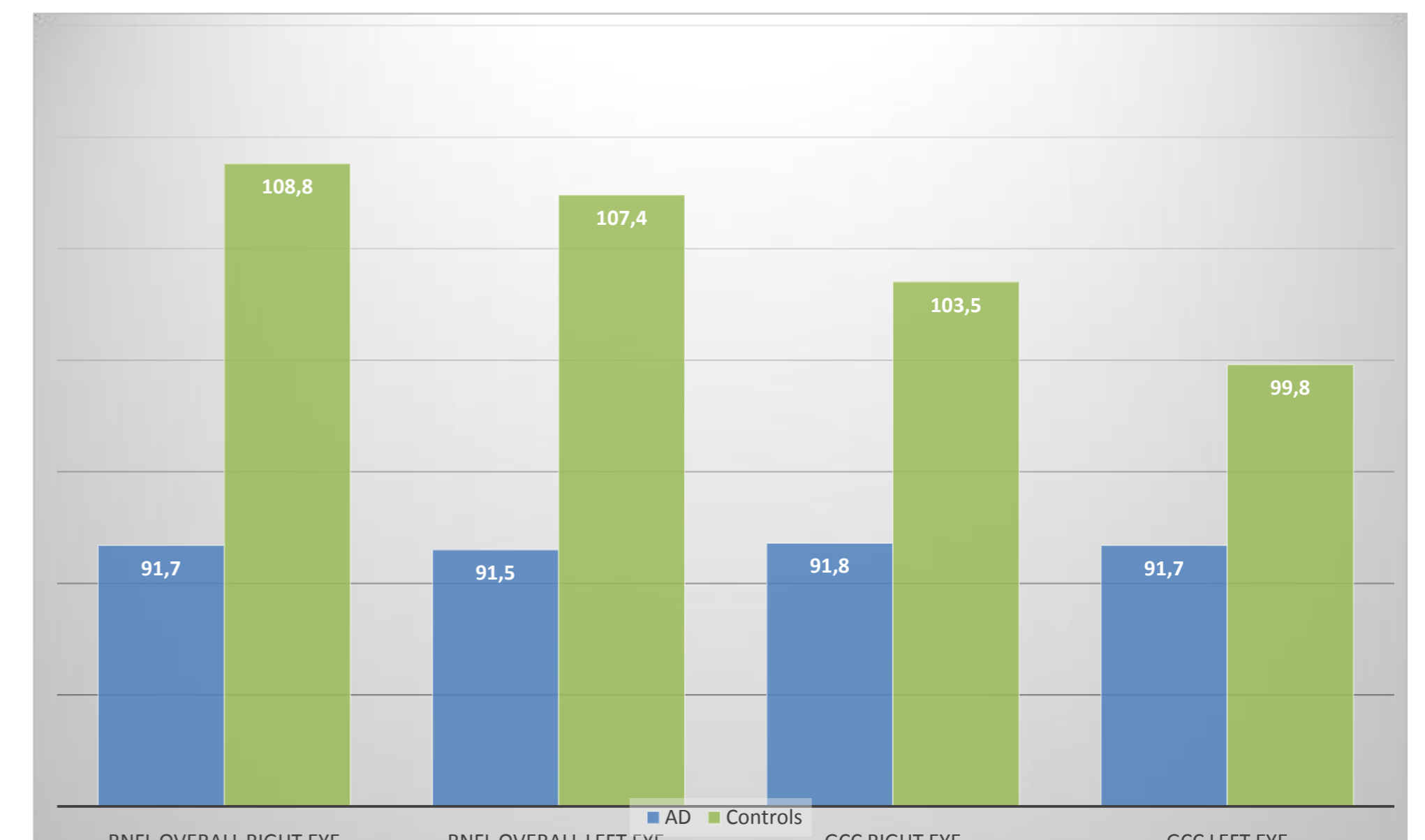
## Methods

- We enrolled 25 subjects with probable AD with age between 55 and 80 years, MMSE score  $\geq 15$  and an education of  $\geq 5$  years, matching them with 17 healthy controls.
- We excluded subjects with behavioral disturbances, which could affect their compliance to the study, with severe internal medicine comorbidities, neuro-sensorial deficits, glaucoma, history of retinal surgery, concomitant retinal conditions, low visual acuity ( $< 5/10$ ), history of drug abuse.
- All subjects underwent the Mini Mental State Examination (MMSE) to assess the global cognitive functioning.
- Assessment of retinal thickness was conducted using Optical Coherent Tomography (device SD-OCT RTVue®Premier). In each eye the following parameters were evaluated: Retinal Nerve Fiber Layer (RNFL); perimacular Ganglionar Cell Complex (GCC); Macular Volume (MV).
- All AD patients underwent a neuropsychological battery. On the basis of the result of each neuropsychological test, we created an index to better estimate the predominantly impaired cognitive functions (memory VS executive functions) in each patient.
- Statistical analysis was performed by using R Core Team 2014 software. Statistic level of significance was set at  $p$  value  $< 0,05$ .

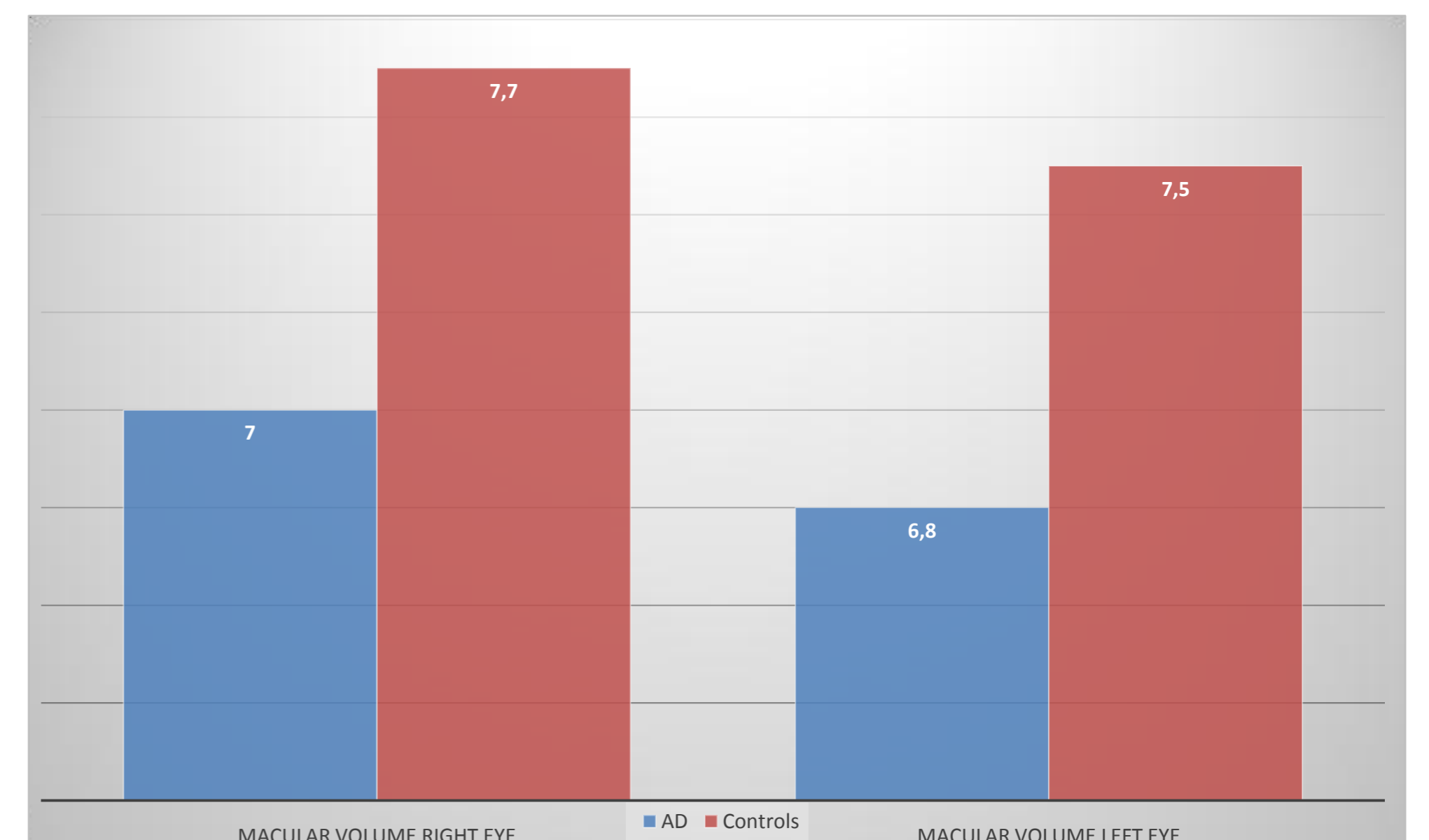
## Results

	AD patients (n= 25)	Healthy controls (n= 17)	P value
Gender	F=14 M=11	F=10 M=7	
Age (years)	74 $\pm$ 3,91	70 $\pm$ 6,74	0,02
Education time (years)	8,4 $\pm$ 4,42	8,9 $\pm$ 3,52	0,63
MMSE	24,2 $\pm$ 3,80	29,2 $\pm$ 0,66	$< 0,001$

## RNFL and GCC ( $\mu$ m)



## Macular Volume ( $mm^3$ )



	Predominant impairment	MEAN	SD	STANDARD ERROR MEAN	Test T di Student		
					t	df	Sig (2-Tailed)
GCC average Right Eye	MEMORY (n= 11)	91,3436	8,32508	2,51011	-0,155	23	0,878
	EXECUTIVE (n= 14)	92,0921	14,16304	3,78523	-0,165	21,534	0,871
GCC average Left Eye	MEMORY (n= 11)	94,7520	23,41996	7,40604	0,688	21	0,499
	EXECUTIVE (n= 14)	90,0008	7,77055	2,15516	0,616	10,532	0,551
RNFL Overall Right Eye	MEMORY (n= 11)	93,00	9,088	2,740	0,496	23	0,624
	EXECUTIVE (n= 14)	90,71	12,946	3,460	0,518	22,775	0,610
RNFL Overall Left Eye	MEMORY (n= 11)	91,36	10,142	3,058	0,188	22	0,853
	EXECUTIVE (n= 14)	90,62	9,359	2,596	0,187	20,663	0,854

## Conclusions

- Our study confirms the association between optic nerve degeneration and AD but the relationship still appears unclear.
- In the AD group no correlation between RNFL and GCC degeneration rate and MMSE score was found. Neuropsychological data did not show any correlation between impairment sub-groups and retinal modifications.
- The flaw of this study is represented by the little number of the enrolled subjects. Longitudinal studies on larger sample of patients are needed to clarify if retinal changes might represent an eligible biomarker for developing a non invasive, low-cost, patient-friendly screening tool.

1. Chiu K et al. 2012. Neurodegeneration of the retina in mouse models of Alzheimer's disease: what can we learn from the retina? Age. 34, 3: 633-649.  
 2. Kergoat H et al. 2001. Normal optic nerve head topography in the early stages of dementia of the Alzheimer type. Dement. Geriatr. Cogn. Disord. 12: 359- 363.  
 3. Paquet, C et al. 2007. Abnormal retinal thickness in patients with mild cognitive impairment and Alzheimer's disease. Neuroscience Letters, 420, 97-99.