

## Alzheimer's Disease and Dementia: utility of OCT

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By 2050, the proportion of the world's population over 60 years will be 22%. More than 40 million people in the world today are affected by Alzheimer's disease (AD) and associated dementia. Older age is characterized by diabetes, obesity, osteoarthritis, pulmonary disease, hearing and visual impairments, depression and dementia. AD is the most common cause of dementia all over the world [1]. AD is a neurodegenerative disease with accumulation of misfolded amyloid  $\beta$ -protein assemblies followed by the hyperphosphorylation of tau proteins forming neurofibrillary tangles with neuronal dysfunction and cellular death. The retina is known as an extension of the central nervous system this suggests representation of neurodegenerative diseases in retinal tissue, and vice versa [2]. Clinical and histologic studies of human AD eyes evidence the involvement of retinal ganglion cells (RGC) and retinal nerve fiber layer (RNFL) especially affecting the macular area (inner retinal thinning) [3]. Optical Coherence Tomography (OCT) is the most important advance in retinal disease diagnosis. OCT is a non-invasive in vivo imaging technique creating a cross-sectional image of ocular tissues. Swept-source OCT provides excellent detail for evaluating neurosensory retinal morphology and until now is the most powerful diagnostic tool in retinal diseases and in many neuro-ophthalmological disorders with and without visual symptoms. With OCT it is possible to study RGC cells and RNFL loss. Different studies showed a significant loss of RGC and a diffuse RNFL reduction in AD patients [4-6]. RGC layer and their axons constitute approximately one-third of the macular thickness. In patients with Alzheimer's total retinal thickness in all macular quadrants was lower than in non-AD subjects [4-7]. Studies based on OCT have demonstrated that RGC loss may be an early indicator of neural loss in many neurological diseases such as multiple sclerosis or optic neuropathy [8]. And this is important because RGC loss, predominantly affecting the central macular area, mimics neuronal degeneration in the Alzheimer's brain: so the inner retinal layers seem to be preferentially affected in AD. Therefore, OCT parameters can be used to distinguish AD patients from normal aging. Fronto-temporal degeneration is a type of dementia with neuronal loss in frontal and temporal lobes beginning before the age of 65. While rare, it can affect people in their 40's and 50's. In these patients as demonstrated by OCT imaging significant thinning is found affecting outer retinal layers without inner retinal thinning [9]. So you can think that different types of dementia can manifest as different OCT findings. All this data support OCT examination of the eye as a non-invasive technique of diagnosis in dementias.

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