Cortical Thickness Analysis in Mild Cognitive Impairment and Alzheimer's Disease

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PURPOSE: In contrast to volumetric analysis, co
rtical thickness measured from the cortical surfaces is a direct index across the entire cerebral cortex to analyze the cortical mass. The purpose of this study is to investigate and compare the regional change of cortical thickness in the whole brain with Alzheimer's disease (AD) and mild cognitive impairment (MCI).

METHODS:
19 Patients with AD, 8 patients with MCI, and 19 age-matched control subjects participated in this prospective study. T1-weighted 3D-SPGR scan was acquired for each subject. These T1-weighted images were nonuniformity corrected and registered into stereotaxic space. For thickness measurement, inner and outer cortical surface were reconstructed by CLASP algorithm. Then outer cortical surface was expanded so that each vertex between outer and inner surfaces is related. Cortical thickness is measured at every cortex, and smoothed using 10mm Gaussian kernel.

RESULTS:
In patients with AD, significant reduction in cortical thickness was found in both parahippocampal gyri, frontal and parietal regions, especially on left hemisphere (p<0.01, corrected by FDR). In patients with MCI, significant reduction in cortical thickness was found in both anterior parahippocampal gyri, focal area of left frontal and parietal region (p<0.01, corrected by FDR). There was no significant reduction in cortical thickness in right hemisphere.
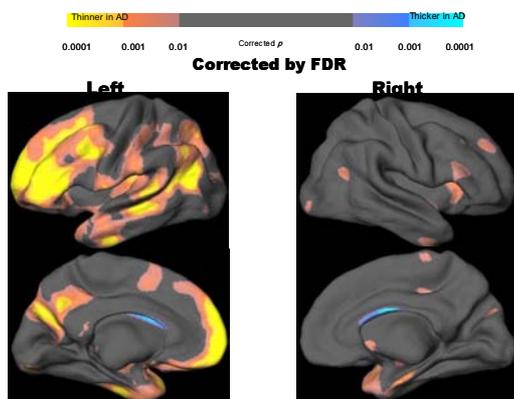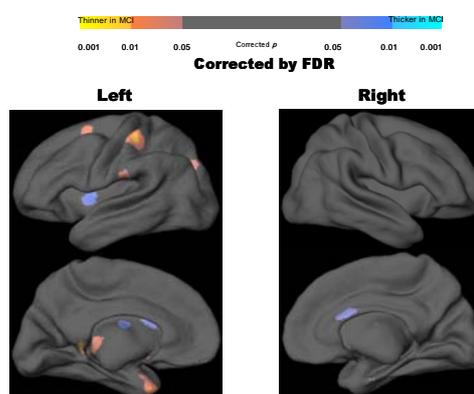

Figure 1. Cortical thickness reduction in AD

Figure 2. Cortical thickness reduction in MCI

CONCLUSION: Using cortical thickness, AD showed more widespread loss in cortical thickness than MCI and different pattern of involvement, which is consistent with the findings on the distribution of neuropathological changes in AD. This result suggests that cortical thickness analysis may provide the direct index of gray matter loss in the disease.