Purpose:White matter (WM) damage has been reported in Alzheimer's Disease (AD) and Mild Cognitive Impairment (MCI) in diffusion tensor imaging (DTI) studies. DTI provides microstructural information about WM integrity and coherence by measuring fractional anisotropy (FA) values. The aim of this study was to investigate WM abnormalities in AD based on voxel-wise comparison with controls and to explore their relationship with cortical atrophy and WM integrity detected by voxel based analysis.

Methods:Sixty individuals (20 controls, 20 MCI and 20 AD) with age-matched underwent DTI and volumetric MRI. Voxel-based tract based spatial-statistics was used to obtain whole-brain maps of WM bundles for FA and mean diffusivity(MD). Voxel-based morphometry was conducted to detect regions of gray matter (GM) atrophy in the AD, MCI group relative to the control group. FA maps were processed to make voxel-wise comparison of anisotropy in whole brain between each the two groups. The relationship between locations of abnormalities in the WM and GM were examined

Results:Significant reductions in FA were found in the WM of both medial temporal lobes, bilateral superior longitudinal fasciculus, bilateral internal capsules, as well as the WM of left middle temporal gyrus and right superior parietal lobule, the body and genu of the corpus callosum, cingulum, and the uncinate, superior longitudical fasciculus in patients with AD. Although the decrease in FA was consistent with cortical volumetric reduction in both temporal lobes, the widespread involvement of superior longitudinal fasciculus and uncinate fasciculus was dominant in these WM findings.

Conclusions:Voxel-wise comparison of whole-brain anisotropy revealed widely distributed disintegration of WM in AD. The WM shows a different pattern of degeneration from GM and may be an independent factor in the progress of AD. These results suggest that DTI analysis of WM structural integrity can serve as potential biomarkers of AD progression.