Background and Hypothesis: Magnetic resonance imaging (MRI) has become a useful tool in monitoring the progression of Alzheimer’s disease. Previous surface-based analysis has focused on changes in cortical thickness associated with the disease. The objective of this study is to analyze MRI-derived cortical reconstructions for patterns of atrophy in terms of both cortical thickness and cortical volume. We hypothesize that Alzheimer’s Disease progression will be associated with a more significant change in volume than thickness.

Experimental Design or Project Methods: MRI data was obtained from the Alzheimer’s Disease Neuroimaging Initiative (ADNI). All subjects with baseline and two-year 3T MRI scans were included. Segmentation of MRIs into gray and white matter was performed with FreeSurfer. Subjects whose scans did not segment accurately were excluded. Surfaces were then registered to a common atlas with Ciftify, and anatomically-constrained Multimodal Surface Matching (aMSM) was used to analyze longitudinal changes in each subject. This produced continuous surface maps showing changes in cortical surface area and thickness. These maps were multiplied to create cortical volume maps. Permutation Analysis of Linear Models (PALM) was used to perform two-sample t-tests comparing the maps of the Alzheimer’s and control groups.

Results: Preliminary analysis of nine Alzheimer’s subjects and nine control subjects produced surface maps displaying patterns that were expected given previous research findings. There was increased volume and thickness loss in Alzheimer’s subjects relative to controls, with relatively high loss in structures of the medial temporal lobe. Future analysis of a larger sample will determine whether statistically significant differences exist between the Alzheimer’s and control groups in terms of thickness loss and volume loss.

Conclusion and Potential Impact: If significant results are found, surface-based analysis of cortical volume may allow for detection of atrophy at an earlier stage in disease progression than would be possible based on cortical thickness.

References