Numerous separate PET-MRI imaging studies in Alzheimer’s disease (AD) have been performed to study characteristic brain alterations including brain atrophy with earlier involvement of medial temporal lobe, brain hypo-perfusion in the posterior cingulate and parietal regions, reduced functional and structural connectivity, and hypo-metabolism [7,8]. In this study we demonstrate the improvements in neuroanatomical and vascular-metabolic quantifications derived from simultaneous nature of multi-modality image acquisitions. All scans started after injection of 10 mCi of FDG tracer followed by a PET/CT scan (45 minutes post-injection). After completion of the routine PET/CT scan, simultaneous PET/MRI acquisition was performed in a 3T PET/MRI whole body system, with dynamic PET-FDG and advanced MRI sequences including arterial spin labeling (ASL) and resting state functional MRI for quantifying cerebral blood flow (CBF) and functional connectivity [1]. Voxel-wise whole brain analysis showed highly consistent FDG uptake patterns of PET/MRI (P<0.01) using two MRI-based AC methods (i.e. Dixon and UTE). The majority of brain voxels (>99%) showed sig-
significant correlations (r>0.6, P<0.05) between PET/MRI (Dixon AC) and PET/CT ratio of standard uptake (SUVR) values with cerebellum as reference region (Figure 1A). Additionally, regional SUVR values from PET/MRI and PET/CT were tightly coupled, e.g., in middle temporal gyrus (MTG) (r=0.97, slope =1.02, P<0.001) (Figure 1B). There was mild coupling between blood flow and metabolism in patients in several brain gray matter regions (r=0.71, P<0.05), including one cluster in temporal cortex (r=0.82, P=0.013) (Figure 2).

In conclusion, integrated PET/MRI images showed comparable image quality to stand-alone imaging modality (both MRI and PET) with the gains of simultaneous multi-parametric acquisitions, reduced scan time and potential patient discomfort.

References


