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SYSTEM AND METHOD FOR MULTI-MODALITY QUANTIFICATION OF NEUROINFLAMMATION IN ALZHEIMER 'S DISEASE

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Background: One in three seniors will die of Alzheimer's disease (AD) or other neurodegenerative diseases. As the prevalence of AD increases rapidly, there is a strong need for early diagnoses and the ability to evaluate efficacy of drug treatments. Typically, a combination of neurological tests, physical tests, and imaging are used to rule out other causes in the diagnosis of AD. However, imaging itself is often inconclusive and cannot identify the beta-amyloid plaques, neurofibrillary tangles, and white matter abnormalities that are characteristic of AD. Recent studies have suggested that neuroinflammation, along with plaques, tangles, and white matter changes, is required for AD pathogenesis. In the central nervous system, activated microglia are the main drivers of neuroinflammation. If the presence of hyper-activated microglia can be detected, quantification of neuroinflammation can occur. The ability to quantify white matter changes and neuroinflammation provides the opportunity for imaging to be used for AD diagnoses and evaluation of treatment efficacy.

Technology Description: A novel method of Diffusion Basis Spectral Imaging (DBSI) has been developed to identify white matter abnormalities and neuroinflammation. DBSI uses multiple-tensor modelling of diffusion weighted MRI signals to quantify neuroinflammation. This imaging-based quantification method has been shown to have excellent test-retest stability and high sensitivity to AD progression. In fact, using DBSI, neuroinflammation was detected prior to white matter changes in preclinical AD patients. Compared to other currently available methods of measuring neuroinflammation (lumbar puncture or PET), our DBSI method is non-invasive and safe as the image-derived marker does not include radioactive agents or contrast mediums. In addition, our computational method is less expensive than contrast agents used with PET.