AbstractID: 10732 Title: Quantifying Magnetic Moments and Susceptibilities of Small Spherical Objects in MRI

Purpose: To quantify magnetic moment and susceptibility of any small object to monitor the progression of neurodegenerate diseases and measure the amount of nanoparticles *in vivo* in MRI. **Methods and Materials:** We have been developing the CISSCO(Complex Image Summation around a Spherical or Cylindrical Object) method in the past [1,2]**.** This method involves summing up complex signals from voxels within a defined circle or sphere, whose center coincides with the center of the object. The effective magnetic moment of a spherical object can be numerically solved from complex signals within three concentric spheres [2]. The phantom study is presented here. Two different diameter sizes of glass beads, 3mm and 5mm, were imbedded in the gel. The gel phantom was scanned by a 1.5T MRI system with a 3D multi-echo gradient echo sequence and a spin echo sequence. The gradient echo sequence was used to determine the effective magnetic moment. The volume measurements of glass beads were analyzed from the spin echo sequence. To confirm the accuracy of the measurements from the CISSCO method, the magnetic moments of glass beads were also measured by SQUID(Superconducting Quantum Interference Device). The magnetic susceptibilities of glass beads were properly calculated and compared between SQUID and MRI. **Results:** The measured magnetic moments and their uncertainties at different echo times agree with each other. The uncertainties of volume measurements from the spin echo sequence are less than 5% of the actual volumes of glass beads. In addition, the calculated magnetic susceptibilities from MRI agree well with those from SQUID. **Conclusions:** Our phantom study demonstrates the feasibility of the CISSCO method that can be used to accurately quantify the magnetic moment and susceptibility of a small object such as microbleeds or implanted nanoparticles.
Ref:[1]Cheng et. al, *MRI*, 2007, pp.1171–1180.[2]Hsieh et.al, Med. Phys., 2008, p. 2906.