Correlation Chemical Shift Imaging with Sparse-FFT and Real-time Motion and Shim Correction

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I. INTRODUCTION

In-vivo 2D Correlation Spectroscopy (COSY) allows the unambiguous assignment of metabolites in localized regions from brain or other organs.

Two major artifacts limit the quality of in-vivo 2D COSY:
1) motion artifacts due to subject movement
2) ringing artifacts due to truncation of t1 dimension.

Here, we show that we can improve in-vivo 2D COSY by:
1) sparse sampling of t1 dimension based on sparse Fourier (sFFT) transform [1,2]
2) real-time motion correction, shim update and reacquisition (ReShMoCo) [3]

II. METHODS

Figure 1. Pulse sequence for Correlation Chemical Shift Imaging [4] with sparse t1 sampling and real-time motion correction. A dual echo EPI volume navigator is played in each TR before spectroscopy. Multivoxel spectral localization is obtained with adiabatic low power GOIA-W(16,4) pulses and spiral readout gradients.

Figure 2. Correlation Chemical Shift Imaging in phantom. A matrix of 16x16 voxels was acquired with sparse sampling of t1 dimension and full sampling.

Figure 3. Correlation Chemical Shift Imaging in human brain. A matrix of 16x16 voxels was acquired with sparse sampling of t1 dimension and full sampling.

III. RESULTS

Figure 4. Motion correction of Correlation Chemical Shift Imaging in phantom.

Static: spectra acquired without moving the phantom.
Motion + ReShMoCo: spectra acquired during phantom movement with motion correction.

V. CONCLUSIONS

> Sparse FFT reduces the t1 ringing artifacts observed in localized COSY.
> Motion correction reduces the artifacts associated with subject movement.
> Their combination provides robust acquisition of COSY in clinical applications.


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