Abstract 614

Accelerated Field-Cycling MRI using Keyhole Imaging

Type: Scientific Session communications

Topic: Preclinical Studies and Basic Science / Novel contrasts and methods

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Purpose / Introduction

Fast Field-Cycling MRI (FFC-MRI) [1] is an emerging technique that adds a new dimension to conventional MRI by making it possible to rapidly vary B_0 during a pulse sequence. By doing this it is possible to observe how the NMR relaxation rates of biological tissues vary with magnetic field strength - information which can be employed as a useful contrast mechanism. In this work we have made use of the keyhole MRI technique[2] in order to reduce FFC-MRI scan times. By only updating the low spatial-frequency region of k-space with each field-cycling experiment, contrast derived from the FFC technique is maintained while the scan time is dramatically reduced.

Subjects and Methods

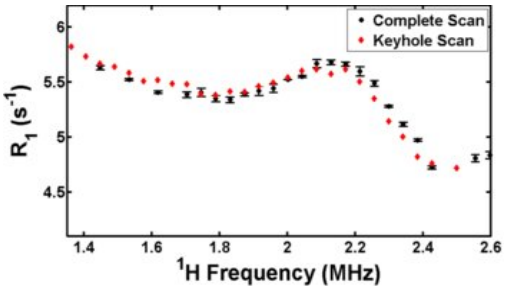
Imaging was carried out on a home-built, whole-body, field-cycling imager with a 59 mT detection field. The data collected were reconstructed by combining an initially acquired complete k-space matrix with a set of partial k-space matrices, one obtained at each evolution field value. The total acceleration factor achieved was 4, compared to conventional imaging.

The technique was used to derive R_1 dispersion curves (R_1 vs Larmor frequency) from a phantom consisting of cross-linked bovine serum albumin (BSA) across a field range of 32 mT to 59 mT.

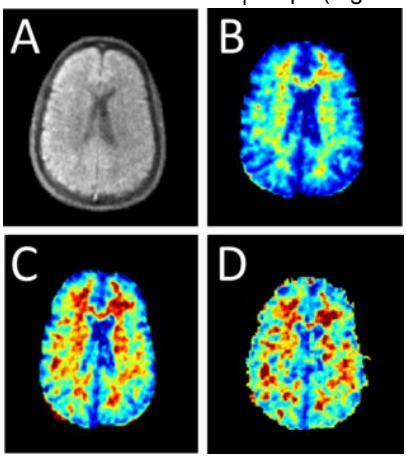
To assess the techniques performance *in-vivo,* brain images were acquired from a volunteer and were used to derive R_1 maps at 49 mT and 59 mT, requiring a scan time of 5 minutes per R_1 map.

Results

R_1 dispersion curves derived from cross-linked bovine serum albumin using the keyhole technique show excellent agreement with results obtained using a conventional full k-space scan (Figure 1).



The volunteer brain R_1 maps (Figure 2) show a marked difference in contrast owing to the strong field dependence of R_1.



Discussion / Conclusion

This work has demonstrated that the keyhole technique can readily be applied to FFC-MRI and used to obtain significant reductions in scan times while still retaining the same contrast as standard FFC-MRI methods. The reduction in scan time achieved by use of the keyhole technique will significantly improve the applicability of FFC-MRI in volunteer and clinical studies, which we are currently working towards.

References

[1] Lurie D.J. *et al*. Fast field-cycling magnetic resonance imaging. Comptes Rendus Phys. 2010;11:136–148.

[2] van Vaals J.J. *et al.* “Keyhole” method for accelerating imaging of contrast agent uptake. J. Magn. Reson. Imaging 3:671–5.

[3] Lurie D.J., Foster M.A., Yeung D., Hutchison J.M. Design, construction and use of a large-sample field-cycled PEDRI imager. Phys. Med. Biol. 1998;43:1877–86.