Temperature monitoring with MURPS in a reduced field-of-view

M. H. Aljallad[1,2], J. Yuan[3], M. Pilato[3], and L. P. Panych[3]

[1]Physics, University of Massachusetts Lowell, Lowell, MA, United States, [2]Radiology, Brigham and Women's Hospital, Boston, MA, United States, [3]Radiology, Brigham and Women's Hospital, Harvard Medical School, Boston, MA, United States

Introduction

MURPS (Multiple Resolution along Phase-Encode and Slice-Select Directions) enables the tradeoff of spatial resolution in part of the volume to improve the temporal resolution [1] and is especially suited to temperature monitoring [2]. MURPS was implemented for reduced field-of-view (rFOV) imaging using 2D RF excitation so that no additional time would be needed to acquire three MURPS slices compared to the time to acquire a single, full field-of-view slice without MURPS.

Methods

A 2D spoiled gradient-echo (SPGR) sequence was modified for MURPS to produce variable slice thickness and phase encodings. A 2D RF excitation was also implemented for rFOV imaging. The modified sequence was used to monitor a phantom volume heated by focused ultrasound (FUS) in a 1.5T GE Signa MRI system. The experimental setup is shown in Figure 1. Positions of the three unevenly spaced slices of variable thickness are shown in the figure (green lines 1,2 and 3). The gel phantom (4), the curved spherical transducer used to sonicate at 15W (5) and the tank containing degassed water (6) can also be seen in the figure. The imaging parameters used were TR/TE =55/22ms, flip angle =30, bandwidth = 3.57kHz, matrix size of 256x64, FOV =20cm. A comparison of imaging parameters for MURPS and the full FOV scan is given below.

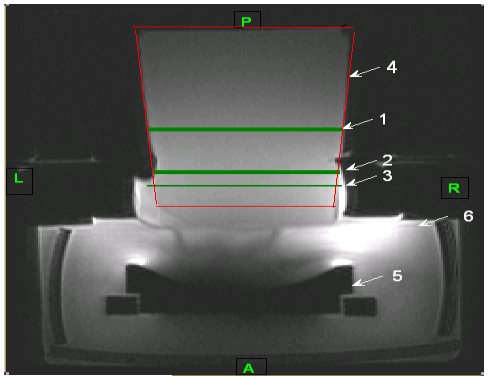

Figure 1

Slice #	Slice 1			Slice 2			Slice 3		
Imaging parameters	Thick-ness(mm)	Phase-encodes	Scan time(s)	Thick-ness(mm)	Phase-encodes	Scan time(s)	Thick-ness(mm)	Phase-encodes	Scan time(s)
Full FOV	3	64	3.52	3	64	3.52	3	64	3.52
rFOV	3	32	1.76	3	32	1.76	3	32	1.76
MURPS/rFOV	3	32	1.76	6	16	0.88	6	16	0.88

Results and Conclusion

Figure 2 shows the temperature change curves versus time for the three MURPS slices. As expected, temperature rise was the highest in the slice nearest to the transducer and smallest in the farthest slice. Figure 3 shows temperature maps for the 3 slices. Note the difference in resolution and SNR in slices 2 and 3 compared to slice 1. In conclusion, when combined with reduced FOV imaging, MURPS enables temperature mapping in a volume covered by 3 strategically placed slices without any sacrifice in temporal resolution.

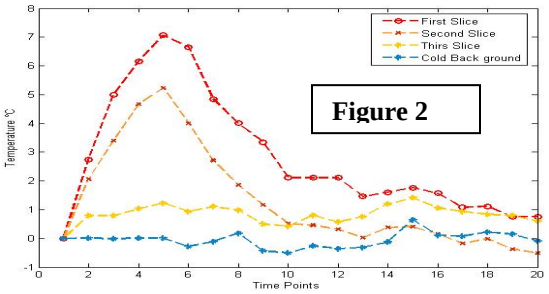

Figure 2

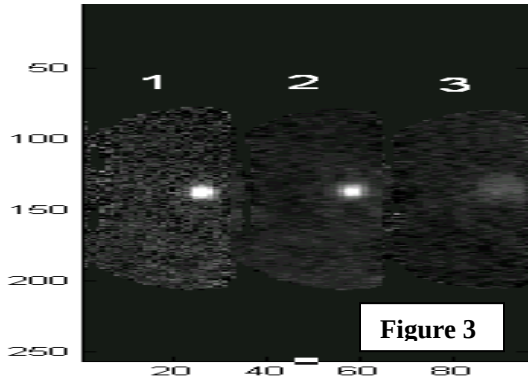

Figure 3

References [1] LP Panych, Magn. Reson.. Med.,45:940-947. [2] NJ McDannold, Proc. ISMRM, 9(2001).

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