

POSTER PRESENTATION

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Design of an adiabatic T₂-preparation method optimized for cardiac motion and flow insensitivity at 3T

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Objective

To develop a T₂-prep method for cardiac imaging at 3T which is less sensitive toward B₁ inhomogeneity, flow and motion than previously described techniques.

Background

T₂ contrast is important for the assessment of acute myocardial edema and coronary morphology. At 1.5T, the standard T₂-prep method uses 4 composite 180° pulses (MLEV4 [1]) providing robust and uniform T₂-preparation, but at 3T, increased B₁ inhomogeneity causes artifacts. Decreasing inter-pulse spacing improves refocusing in the presence of motion and flow. We developed a configurable T₂-preparation allowing up to 4 adiabatic refocusing pulses (B₁-insensitive) to study the effect of inter-pulse spacing on motion-robustness. We compared image homogeneity using MLEV4 as reference.

Methods

The modules employed 800 μs rectangular tip-down /flip-back pulses and a series of adiabatic refocusing pulses (BIREF-1 [2]). With these modules, we acquired mid-ventricular short axis cardiac images in healthy volunteers at 3T (MAGNETOM Verio, Siemens) using an ECG-gated, TurboFLASH sequence and different T₂-prep times ranging from ≤35 ms to 120 ms, in systole and diastole. Four modules were used: A1 (1xBIREF-1), A2 (2xBIREF-1), A4 (4xBIREF-1), and MLEV 4. Separate contours were drawn for myocardium and cavity using ImageJ (NIH). The coefficient of variation was used as a measure of inhomogeneity. Readers (n=3) blinded to

the T₂-preparation scored images on a four-point scale for myocardial/cavity inhomogeneity and endocardial border definition. Statistical comparisons were made by ANOVA with Bonferroni correction.

Results

The effect of the number of pulses and inter-pulse delay is demonstrated in figure 1a and 1b. Signal and homogeneity of myocardium and cavity increased with the number of pulses. The inhomogeneity of the cavity in diastole as measure of flow sensitivity (T₂-prep time 40 ms) decreased with increasing pulse number (A1 = 0.3, A2 = 0.12, A4 = 0.11 and MLEV4 = 0.13). A comparison of A4 with MLEV4 (figure 1c) highlights the improvement due to adiabatic pulses. MLEV4 and A4 have similar inter-pulse spacing, yet across all T₂-prep times, A4 performed better. From the visual scores, A4 scored higher and was ranked first among all sequences.

Conclusions

We developed a B₁, motion and flow insensitive T₂-prep method using adiabatic pulses. Using BIREF-1 refocusing pulses allows shorter inter-pulse spacing without exceeding SAR limitations, and improves homogeneity over the MLEV4 composite pulses.

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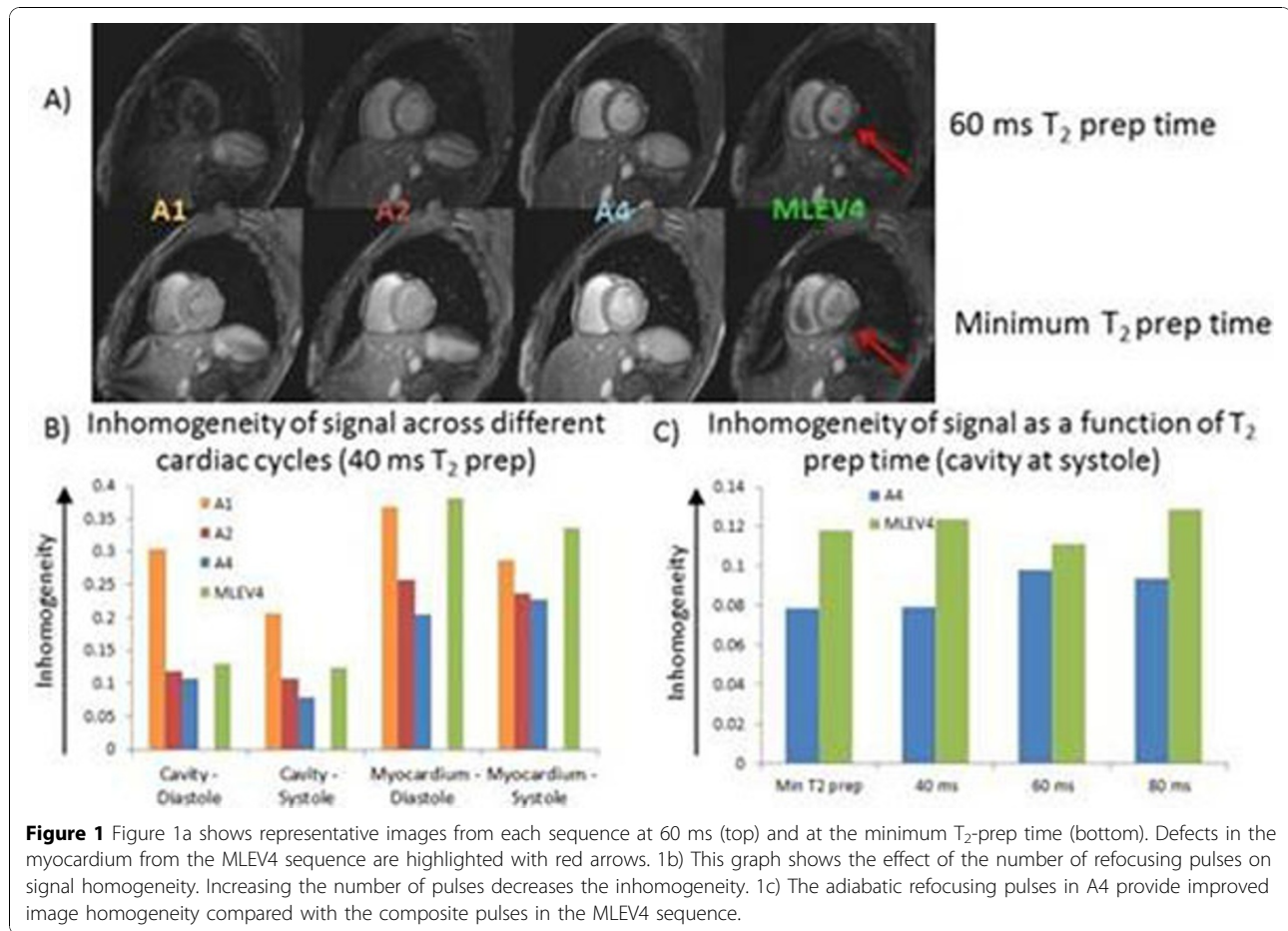


Table 1 Results from visual scoring of images. * = statistically significant (P<0.05) vs MLEV4

	A1	A2	A4	MLEV4
Mean Quality Score	0.17	1.33	2.42	1.83
Mean Rank	0	1.25	2.75*	2.00

References

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