FAT-SATURATED T2PREPARATION MODULE USING COMPOSITE RF PULSES FOR 3 TESLA

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<u>Introduction</u>: A recently developed T2-preparation module for cardiac imaging at high field is insensitive to B0 and B1 inhomogeneity, cardiac motion and flow. Obtained T2 weighted images exhibit bright fat signal that can obscure the signal of myocardium and other muscles. Therefore, a chemical selective saturation (CHESS) is usually applied for fat suppression after the T2-preparation, e.g. in coronary artery MRI. Its quality is often poor and it is unsuited for longer readout durations. In this study, we propose a new fat suppressed T2-preparation module for 3T using binomial composite RF pulses as 90° pulses to more efficiently suppress fat, maintaining robustness towards inhomogeneity, cardiac motion, and flow.

<u>Methods</u>: An oil and water phantom and a volunteer were scanned on a Siemens MAGNETOM Trio 3T MR scanner (16-channel coil) to compare the proposed fat-suppression method with the existing T2-preparation using CHESS fat-suppression. The proposed T2preparation method as shown in figure 1 with integrated fat-suppression uses refocusing pulses shown in a previous study[1] to be insensitive to cardiac motion, blood flow, B0 and B1 field. The preparation module is composed of 3 parts. First, a composite binomial pulse consisting of 2 rectangular pulses for tipping water spins onto the transverse plane using 45° – tau – 45° flip angles. Second, four BIREF-1 pulses[2] for refocusing water spins. Third, a composite binomial pulse (45° – tau – -135°) to rotate water and fat spins onto the +Z and –Z axis, respectively. Fat suppression was achieved when the inverted fat spins reached the zero crossing of the fat recovery curve while acquiring the center of k-space during segmented scanning. The scan parameters were 2D FLASH sequence, TR/TE=4.04/1.63ms, T2prep time = 40ms, # of segments=21, water-fat out of phase time = 1.23ms, flip angle=20, Thickness=5mm, trigger pulse =2. To evaluate the performance of fat suppression of the proposed method, volunteer and phantom images were obtained with three modules, 1) adiabatic T2prep pulse without any fat-suppression, 2) with fat-saturation using the CHESS pulse, and 3) our proposed method.

<u>Results</u>:Figure 2 shows the images acquired with the adiabatic T2 preparation and with different fat suppression techniques with identical window level. Figure 2(a, d) shows an image generated by the adiabatic T2preparation pulse without any fat-suppression, (b, e) by adiabatic T2 preparation pulse with existing CHESS RF pulse for fat suppression, and (c,f) by our proposed method in volunteer and phantom. The proposed method provided excellent suppression of pericardial fat that was better than using CHESS.

<u>Conclusions</u>:The proposed T2preparation method with integrated fat-suppression has superior fat suppression performance than existing techniques.

<u>Reference</u>: 1. Rehwald et al. JCMR 2011;13:O14, 2. Ugurbil. JMR 1988, 78:472-497.

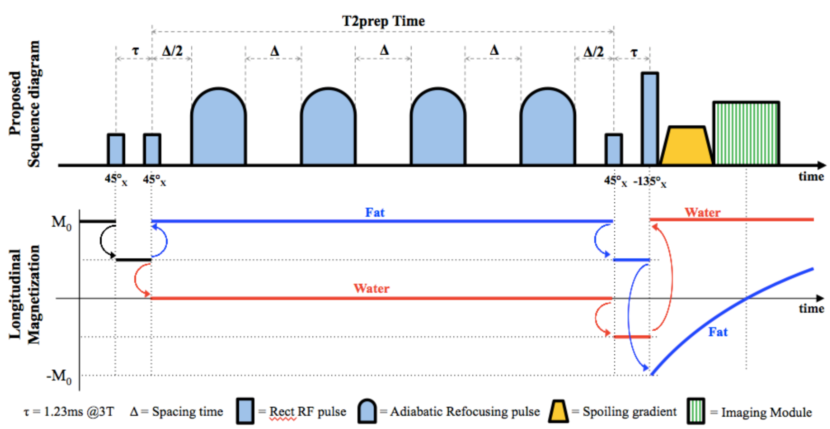

Figure 1. Pulse sequence diagram for proposed T2preparation method with integrated fat-suppression using adiabatic refocusing pulses.

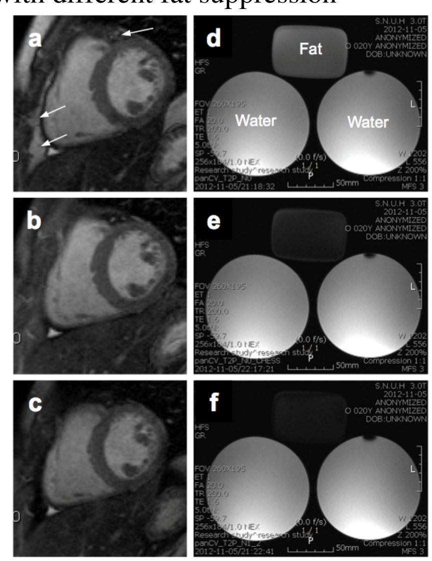

Figure 2. Volunteer and phantom images obtained with the three modules. (a,d) were obtained with existing adiabatic T2prep, (d,e) were obatianed with adiabatic T2prep+CHESS, (c,f) were obtained with proposed method. Note the excellent suppression of pericardial fat by proposed method(c), see white arrows.