Rapid parallel breast MRI with a custom coil array

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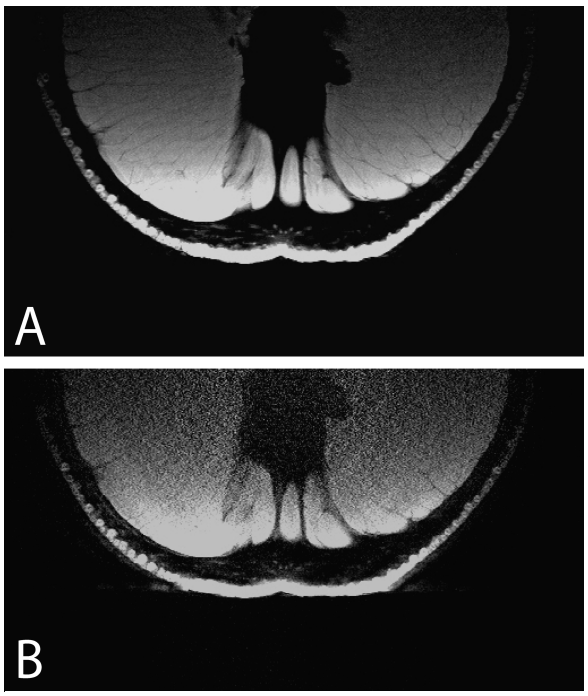

Figure 1: Grapefruit imaged with 8-element coil array with full k-space acquisition (A) and reduction factor of 4 (B).

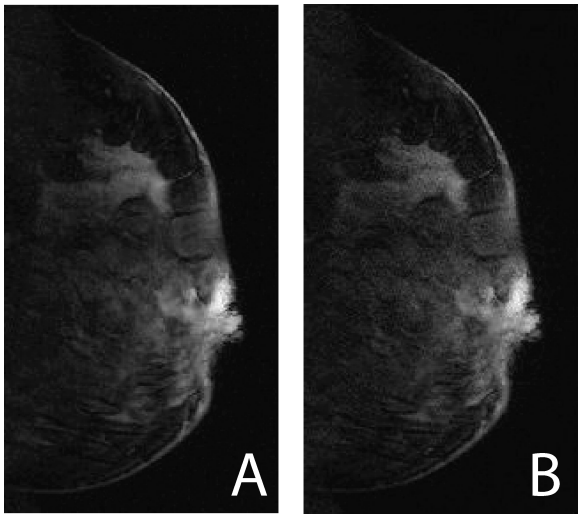

Figure 2: Single sagittal slice of dynamic pre-contrast fat suppressed T1 weighted scan with full k-space acquisition (A) and reduction factor of 4 (B).

Introduction:

Rapid imaging during the dynamic contrast enhanced portion of a breast MRI examination is crucial to achieve high spatial and temporal resolution. A recently presented method for estimation of perfusion parameters in dynamic contrast enhanced breast MRI has shown great promise in improving the specificity of breast MRI (1). The accuracy of this method is improved with higher temporal resolution. At the same time, evaluation of lesion morphology with high spatial resolution images plays a critical role in the accuracy of breast MRI (2). A prototype breast imaging coil has been constructed which has the potential to image with high reduction factors, allowing simultaneous improved temporal resolution and high spatial resolution.

Methods:

A 32-channel parallel breast imaging coil was constructed in the form of four plates, which are placed at the lateral and medial margin of each breast. Each plate measures 15 x 15 cm and contains eight rectangular coil loops which are stacked in the *z* dimension (parallel to the magnet bore) in a ladder configuration. Nearest-neighbor decoupling is achieved with a single shared capacitor between adjacent loops. Each of the eight loops is connected to a separate preamplifier and receiver channel.

Performance of the coil for parallel imaging was evaluated with a phantom study on a 3 Tesla Siemens Trio system employing a single plate with eight elements used to image a grapefruit. A complete k-space was acquired, and reconstruction with reduction factor of 4 was performed with GRAPPA (3). A preliminary *in vivo* breast imaging study was performed with two plates comprising sixteen channels, with reconstruction with a reduction factor of 4 using a multidimensional version of GRAPPA (4) illustrated in Figure 2.

Results and Conclusion:

A coil configuration with coil elements stacked in one direction, such as the ladder configuration, may allow imaging with large reduction factors relative to the number of receiver channels. Some SNR performance is sacrificed for the sake of improved parallel imaging in this configuration. Figure 1 shows expected decrease in SNR, but very little aliasing artifact from k-space undersampling. A decrease in imaging time by a factor of four or greater may lead to increased accuracy of breast MRI by improving parametric perfusion modeling and by allowing high resolution depiction of lesion morphology.

References:

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