



Lower Specific Absorption Rate for Multiband MRI (20110093, Dr. Kamil Ugurbil)

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SAR Reduction Using Multichannel Transmit

A new magnetic resonance imaging (MRI) technology for multiband (MB), also known as Simultaneous Multi Slice (SMS), imaging uses multichannel transmit to overcome fundamental limitations in specific absorption rate (SAR). The approach uses multiple coils for radiofrequency (RF) transmit, in which each set of simultaneously excited slices are excited by an optimal combination of the multiple coils, taking advantage of the fact that each coil generates an excitation signal (transmit B_1 , i.e. B_1^+) of different magnitude and phase over the different slice that cover the sample. Ideally, the coil arrangement would be such that each coil (or different set of coils) generates B_1^+ over a single slice. Then, different slices could be excited at the same time using multichannel transmission by applying the corresponding slice selective pulses using the coils with the appropriate B_1^+ profile. While this ideal situation will not hold in practice, as long as some distinct spatial B_1^+ profiles exist for the transmit coils along the direction of the slices, SAR reduction will still occur.

Faster Image Acquisition

Fast acquisition sequences such as echo planar imaging (EPI), Turbo Spin echo (TSE) or SPIRAL type approaches can image a single slice rapidly but the acquisition has to be repeated multiple times for the different slices that cover the targeted object to be imaged. MB/SMS accelerates volume coverage by all imaging approaches that utilize slice selective acquisition by exciting and acquiring multiple simultaneously, and unaliasing them in the post-acquisition phase using spatial information inherent in an array of receive coils. However, the accelerations that can be achieved is potentially limited by heating effects due to increased power deposition in the sample (i.e. SAR) especially at high magnetic fields. By using multiple coils for RF transmit, SAR is reduced in this new approach compared to multiband pulses applied with a single coil that covers the entire volume of interest. This method allows faster image acquisition (increased acceleration factors) compared to multi-slice volume coverage exciting a single slice at a time, as well as slice accelerated acquisitions with simultaneously exciting multiple slice employing a single RF coil for slice excitation.

BENEFITS AND FEATURES:

- Significant (e.g. ~2 fold or more) reduction in SAR compared to other multi-slice acquisitions
- Faster image acquisition than single slice acquisition
- May allow scans previously not possible due to SAR constraints
- Installed on scanners or via software upgrade

APPLICATIONS:

- MRI applications
- Brain imaging
- Imaging all parts of the human body
- Variety of MR imaging techniques

Technology ID

20110093

Category

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Phase of Development - Proof of Concept

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