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Improved MRI Quality with Gradient Modulation Pulse Sequence (20150133, Dr. Kobayashi, Dr. Garwood)

IP Status: Issued US Patent; **Application #:** 15/153,930

Pulse Sequence Enhancement Improves MRI Image Quality

Magnetic resonance imaging (MRI) image quality is improved by introducing gradient modulation (GM) to Pointwise Encoding Time Reduction with Radial Acquisition (PETRA) after excitation. PETRA faces limitations in specific absorption rate (SAR) and radiofrequency (RF) pulse peak power when using higher bandwidths in human measurements. The GM-PETRA pulse sequence dynamically provides different bandwidth settings between the MR signal excitation and the data acquisition in PETRA, which reduces image-blurring artifacts and keeps SAR and RF peak power low. Inner ear imaging with GM-PETRA captured complex structures of the inner ear and showed significantly less image blurring as compared to PETRA. GM-PETRA improves on current PETRA quality and its SAR and RF peak power limitations without special hardware modification in clinical scanners, and could be used in a wider array of clinical scans, increasing its penetration in the clinic.

Data Acquisition Time and RF Peak Power Reduced

Newer “quiet” MRI sequences such as PETRA face inherent challenges that limit their clinical use. For example, off-resonance frequencies can cause image artifacts and blurring. GM-PETRA overcomes this issue by increasing gradient amplitude after excitation and using higher bandwidth in data acquisition. Higher bandwidth in data acquisition shortens data acquisition time by reducing repetition time (TR). In addition, lower bandwidth in signal excitation in GM-PETRA mitigates the limitations in RF peak power and/or SAR and reduces additional data acquisition time for collecting data around the k-space center in PETRA.

BENEFITS AND FEATURES:

- Reduces image artifacts caused by off-resonance frequencies and T2* signal decay
- Reduces data acquisition time
- Improves image fidelity due to reduced limitation on flip angle due to RF peak power and/or SAR
- Improves PETRA image quality
- Mitigates SAR and RF peak power limitations without special hardware modification in clinical scanners

APPLICATIONS:

- All MRI applications that focus on fast-decaying signals and require low RF peak power and/or specific absorption rate (SAR)
- Increased clinical MRI penetration by offering a wider array of clinical scans
- Clinical MRI use
- Applications where PETRA image quality can be improved

Phase of Development - Prototype development; in vivo experiments.

Technology ID
20150133

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Publications

Gradient-Modulated PETRA MRI

Tomography.org , Volume 1 Number 2 December 2015

Ultrashort Echo Time Imaging Using Pointwise Encoding Time Reduction With Radial Acquisition (PETRA)

Magnetic Resonance in Medicine , 2012 Feb;67(2):510-8