High-Resolution R_2 Mapping with Chemical Species Separation

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WARF: P120316US01

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The Wisconsin Alumni Research Foundation (WARF) is seeking commercial partners interested in developing methods for estimating transverse relaxation rate (R_2*) while simultaneously performing water-fat separation using MRI.

Overview

In magnetic resonance imaging (MRI), the amount of data required to reconstruct an image can be decreased using 'partial k-space' sampling. This type of sampling enables shorter breath-holds, reduced scan time and more flexibility in echo timing.

Such flexibility can improve noise performance and avoid water-fat swapping. It also helps measure transverse relaxation rate, or R_2*, which has important applications like assessing iron content in the body and tracking superparamagnetic iron oxides.

However, reconstructions that take advantage of partial k-space sampling show problems. Results may be blurry and lose spatial resolution. Others require increased complexity. A new approach should overcome these drawbacks.

The Invention

UW–Madison researchers have developed a method for producing a quantitative map of R_2* while separating signal contributions from two or more chemical species, like fat and water.

The method works by producing quantitative R_2* maps, quantitative fat fraction maps and separate R_2*-corrected water and fat images. A low-resolution field map and a common water-fat phase are used to demodulate the effects of these parameters from the acquired data while separating the water and fat signals.

In this way, water, fat and R_2* can be estimated simultaneously. A full resolution R_2* map is reconstructed in addition to water, fat and fat fraction images that are corrected for the effects of R_2*.

Applications

- Clinical and preclinical imaging, including fat fraction and iron quantification in the presence of iron overload
- Potentially fat quantification in the absence of iron overload
- Detecting and tracking superparamagnetic iron oxide particles

Key Benefits

- Takes better advantage of partial k-space sampling
- Provides full resolution quantitative R_2* maps
- Enables shorter breath holds and free-breathing scan times
- Accounts for spectral complexity of fat and T_2* signal decay, in contrast to previous methods

- Works with chemical species other than water and fat, including silicon and hyperpolarized carbon-13

Additional Information

For More Information About the Inventors

- Scott Reeder
- Diego Hernando Arribas

Related Technologies

- For information about a method for improved water-fat signal separation in MRI imaging, see WARF reference number P090389US01.
- For more information about a method for measuring R_2* corrected for confounding factors, see WARF reference number P110135US01.

Tech Fields

- Medical Imaging : MRI

For current licensing status, please contact Jeanine Burmania at jeanine@warf.org or 608-960-9846