Physics

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***Introduction***

In order to speed up the process of data acquisition, several coils are used in parallel instead of a single coil system. Employing several parallels and independent coil receiving elements reduce the steps of phase-encoding. Thus, spatial encoding to a certain amount that was originally achieved by gradients for phase encoding is now incorporated using data evaluation from multi-coil elements with sensitivity profiles of spatially different coils. In this process, a reduction in steps of phase encoding is achieved by sample density Δk reduction in k space1. Reduction of raw data can have a factor between 2 to 6 and can be typically achieved by employing parallel imaging in the same direction that is a combination of densities emanating from reduced sampling in two directions of phase encoding which is possible in 3D MRI that helps in reducing higher numbers of factors. The reduction of maximum factors is bound by MRI system separate receiver channels. One of the main in the parallel imaging is the introduction of the techniques such as SENSE (sensitivity encoding) and SMASH (simultaneous acquisition of spatial harmonics). In these sort of techniques, the position that is unique which arises from each tissue signal is both encoded by using the encoding of the traditional gradient (k-space) as well as using simultaneously coils from multiple receivers. By employing this, field of view (FOV) effective reduction is possible using each coil for the acquisition of data that reduces the rate requirement for Nyquist sampling of the k-space. SMASH and SENSE currently are the most parallel imaging prevalent techniques. Although both techniques employ receiver coil position in reference to signal to encode for the patients, SMASH generates directly the k-space missing lines before use of the FFT that is used in final image reconstruction. SENSE, on the other hand, uses the sensitivity profile of the receiver coil to do the same operation in space image after each coil recorded undersampled data is reconstructed into the aliased image2. In GRAPPA sampling only a small number of steps of phase-encoding is employed. All these techniques are used to aim at compromising the best way in minimizing artefacts of localized image and noise of the image.

End Notes

1. Griswold, M. (2005). *U.S. Patent No. 6,841,998*. Washington, DC: U.S. Patent and Trademark Office.
2. Sharif, B., & Bresler, Y. (2006, April). Optimal multi-channel time-sequential acquisition in dynamic MRI with parallel coils. In *3rd IEEE International Symposium on Biomedical Imaging: Nano to Macro, 2006.* (pp. 45-48). IEEE.