ASSET Enabled Turboprop: an Improved PROPELLER Sequence for Motion-Corrected T2 Imaging

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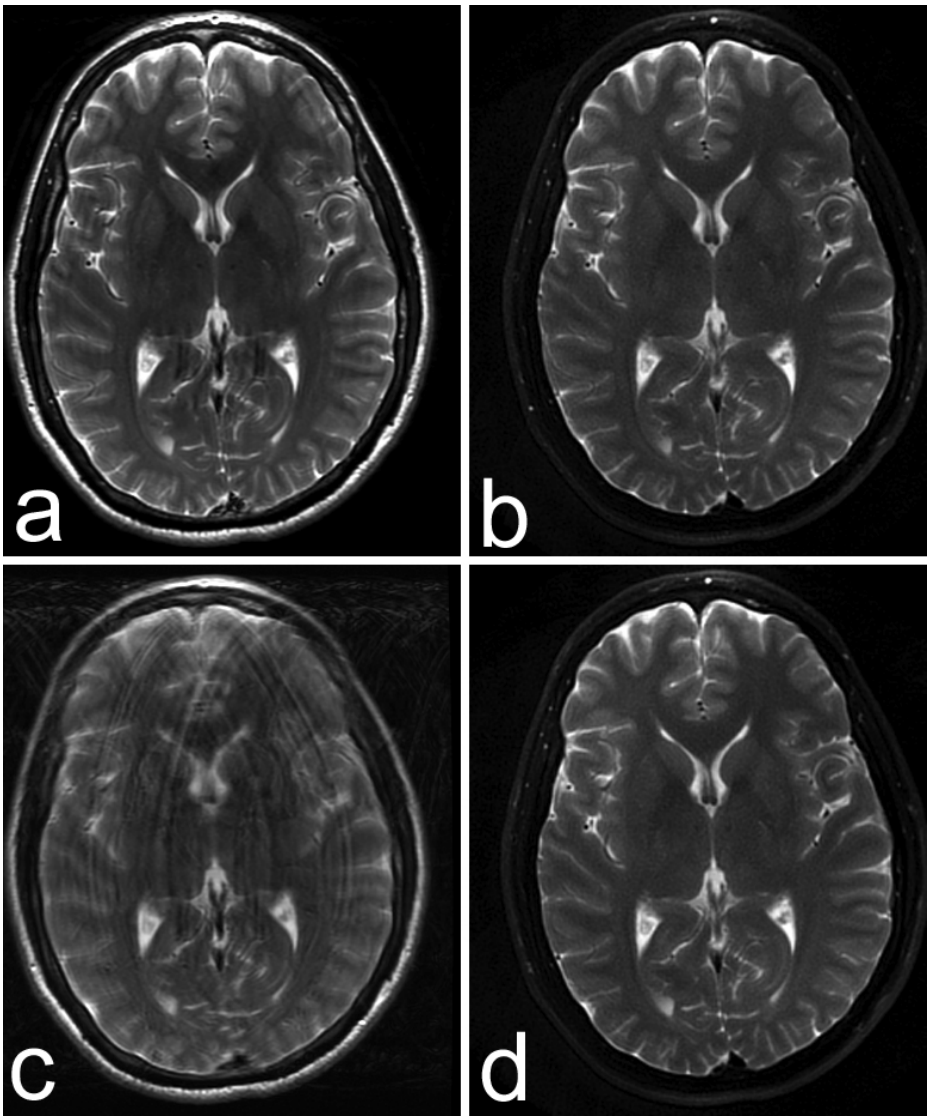
Introduction: Motion artifact is a significant problem in MR imaging of the brain. The T2 PROPELLER technique using motion correction has been shown to be superior to conventional T2 FSE imaging in the moving subjects (1). Both turboprop and multi-coil imaging (SENSE, ASSET) generate wider blades of data, which facilitates motion correction (2,3). These improvements are combined in this work to generated T2 motion corrected images that compare favorably to high resolution conventional T2 FSE imaging in both the cooperative and uncooperative subject, due to the added benefits of turboprop and ASSET.

Methods and Results: This method was implemented on a GE 1.5T EXCITE scanner with echo-speed plus gradients and an 8-channel phased array coil, and compared to a standard FSE sequence [scan time 2'30", matrix 256x192 (FSE) vs. 256 diameter (PROPELLER), all other parameters kept similar]. In this application, chemical fat saturation was used to mitigate small streak artifacts that can appear with turboprop. For the modified PROPELLER technique, an echo-train length of 16, with 5 lines per spin echo (turboprop), and an ASSET factor of 2, blades were 160 lines wide in k-space.



Turboprop and ASSET are mutually beneficial, in that subtle reconstruction artifacts that can appear in ASSET/SENSE methods tend to be incoherent after rotated blades are combined to make the final image. Note the subtle ringing artifact overlying the periphery of the brain that is commonly seen in FSE in Fig. 1(a), but not in PROPELLER (Fig. 1b). Note the marked reduction in image quality with motion for conventional FSE (Fig. 1c); In Fig 1d, observe that although the head is motion corrected to a slightly different orientation than in Fig 1b (no motion), the images are otherwise indistinguishable.

Discussion: The motion-corrected PROPELLER technique, with the addition of turboprop and ASSET, generates high resolution T2 weighted images that offer improved image quality over conventional high resolution T2 FSE imaging in subjects that are both lying still and moving.

References:

1. Forbes KP, Pipe JG, Bird CR, Heiserman JE. JMRI. 14(3):215-22.
2. Pipe JG. ISMRM 10th Annual Meeting; Honolulu, Hawaii; 2002.
3. Pipe JG. ISMRM 11th Annual Meeting; Toronto, Ontario; 2003.

Fig. 1. Images of a volunteer holding still (a,b) and moving (c,d) using conventional FSE (a,c) and ASSET-enabled turboprop (b,d)