

# Ultra-fast T2-w. single shot TSE and single shot FLAIR MR imaging combining SENSE, variable refocusing angle and partial Fourier: Evaluation on cooperative and non-cooperative MS patients in comparison to standard TSE and FLAIR imaging

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**Introduction:** Due to their insensitivity to susceptibility effects Turbo Spin-echo (TSE)-based sequences appear to be very attractive for high field applications. And in addition the potentially higher SNR offers to reduce the scan time and / or to increase the spatial resolution. However their application at 3T interfere with high RF power deposition (exceed the specific absorption rate SAR limits for patient safety) especially with single shot TSE sequences. It is well known that the SAR reduction can be obtained by shortening the echo train with techniques like partial Fourier, parallel imaging (SENSE) and by using variable refocusing angle ([1], [2], [3]). Combining these techniques with single shot and high SENSE-factor enable scan time shortening of about factor 10 for T2-w. TSE imaging and of about factor 5 for TSE-FLAIR [4]. Purpose of the study was to evaluate these T2-w.-TSE and -FLAIR images concerning the diagnostic image quality of non-cooperative patients in comparison to cooperative patients. And in addition to evaluate the reliability of the diagnostic value we selected MS patients.

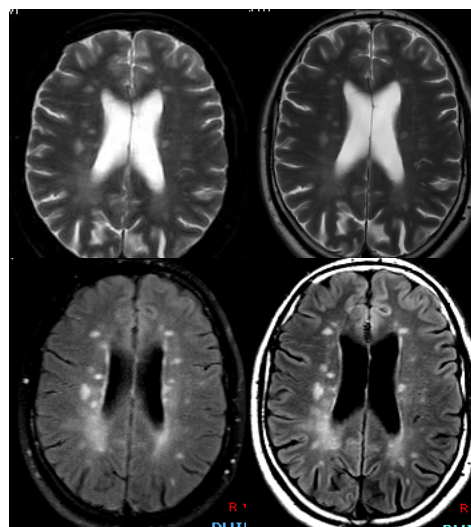
**Material and Methods:** Investigations were done with a 3T Achieva X-Series (Philips Medical Systems, Best NL) using a commercially available phased-arraycoil (8-channel SENSE Head coil1). All images were acquired with the same spatial resolution (1.0x1.0 mm in-plane, 5.0 mm slice thickness). In both cases – conventional and fast techniques – the same TR/TE were used (TSE with TR/TE: >4000/ 80ms; FLAIR with TR/TE 12000/100ms). Fast imaging were combined with SENSE (reduction factor of 4), partial Fourier (factor 0.625) and flip angle sweep of 75°. The scan time for fast imaging were for TSE 8.4s and for FLAIR 48s. In this study were 8 patients and one volunteer with MS under therapy included. Image analysis was done in consensus by two radiologists with respect to motion artifacts and overall image quality.

**RESULTS** A comparison of the conventional TSE and FLAIR imaging vs the fast imaging is shown in Figure 1. The number of detected lesions were in both methods the same for cooperative patients (5/8). Concerning the head motion of the non-cooperative patients (3/8) a correct diagnosis were difficult or impossible with the conventional technique, whereas in the fast images the lesions could be correct detected. The latter could be demonstrated in a volunteer examination with and without head motion.

**DISCUSSION** Initial results reveal the strength of the method, where extreme short scan time maintaining the spatial resolution. This technique potentially enables diagnostic image quality in extremely difficult cases with small lesions at non-cooperative patients.

Figure 1.

Left fast imaging; right conventional imaging  
TSE with 8.4s; right conv. 98s  
FLAIR with 48s, right conv. FLAIR with 240s scan time



- [1] Alsop DC: Magn Reson Med 1997; 37:176-184
- [2] Hennig J, Scheffler K, Magn Reson Med 2001; 46: 6-12
- [3] Hennig J, et al. Magn Reson Med 2003; 49: 527-535
- [4], Gieseke-J et al.Proc. ISMRM: 2004 11 74