Kinematic MR imaging Using 3D FIESTA and Diffusion Tensor Imaging on an Open-type MR Scanner.

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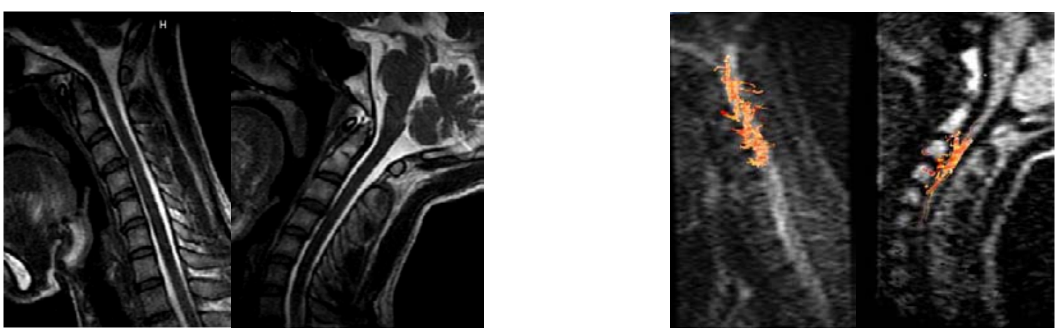
Introduction: Kinematic MR imaging technique has been performed to evaluate morphological changes of cervical spine and spinal cord in normal subjects and patients [1]. Among several recent advanced MR imaging techniques, short TR three-dimensional coherent steady state free precession (3D FIESTA) produce high SNR images at very short data acquisition time compared with conventional T2-weighted images and diffusion-tensor imaging (DTI) can reveal the internal structures and abnormal pathological conditions in vivo. The purpose of this study was to evaluate kinematic MR images using 3D FIESTA and DTI on an open-type MR scanner in normal subjects as feasibility study.

Methods: A total of five healthy volunteers without neurological disorders (mean age 31) participated in this study. All MR imaging were performed on an open-type MR scanner (Signa Profile 0.2 Tesla, GE-YMS, Tokyo, Japan). To avoid susceptibility artifacts and image distortion, line scan diffusion tensor imaging (LSDTI) [2-4] was applied for this study, instead of vast majority method, single-shot echo-planar imaging. The imaging protocol included localizing scan, 3D FIESTA and DTI scans with the imaging parameters as follows. 3D FIESTA: TR/ TE =13/6.5 ms, matrix 256×128 (512×512 reconstructed), bandwidth = 20.5 kHz, FOV = 240×240 mm, slice thickness/gap=5/0 mm. LSDTI: TR/ TE =380/116 ms, matrix 128×64 (256×128 reconstructed, frequency × column), bandwidth = 3.2 kHz, FOV = 260×130 mm, slice thickness/gap=6/0 mm, b value = 700 s/mm^2 along six directions. All 3D FIESTA and LSDTI images of cervical spine and spinal cords were acquired in sagittal plane, in both flexion and extension position. Subsequently, apparent diffusion coefficients (ADCs) and fractional anisotropy (FA) maps were calculated from the obtained LSDTI images on a pixel by pixel basis using a software (Functool 2, General Electronic Medical Systems, Milwaukee, WI). Moreover, fiber assignment by means of continuous tracking was used with an FA threshold of 0.22 using dTV‖ software (Image Computing and Analysis Laboratory Department of Radiology, University of Tokyo, Tokyo, Japan). All 3D FIESTA and fiber-tracking images were evaluated visually by two neuroradiologists. For evaluation of ADCs and FA, a region of interest (ROI) analysis was performed. ROIs were placed in the center of spinal cord at the spinal canal levels.

Results: Excellent morphologic kinematic MR images using 3D FIESTA were obtained. Fiber-tacking images showed dynamic alterations of spinal cord fibers during flexion-extension motion, for example, extended and curved spinal cord fibers were observed. There was no statically significant difference between flexion and extension position images with respect to ADCs and FA values.

Discussion: Although further investigation may need to prove usefulness of this technique in clinical use, our results suggest that kinematic MR imaging using 3D FIESTA and DTI on an open-type MR scanner has significant potential to show more physiological information of spinal cord in addition to conventional MR examinations.



A **B** **C** **D**

Figure. High quality kinematic MR images using 3D FIESTA in flexion (A) and extension position (B). 3D fiber-tracking for cervical spinal cord in flexion (C) and extension position (D) with some missing fibers and unreliable fibers.

Reference

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