



Efficacy of the 3D T2-SPACE sequences compared with the GRE 3D MRI

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Disclosures

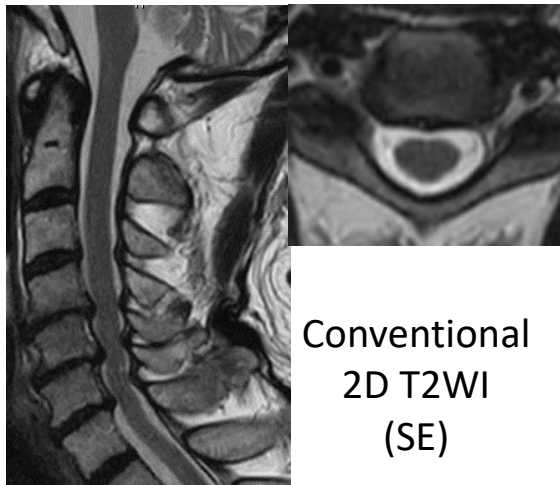
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Introduction & Background

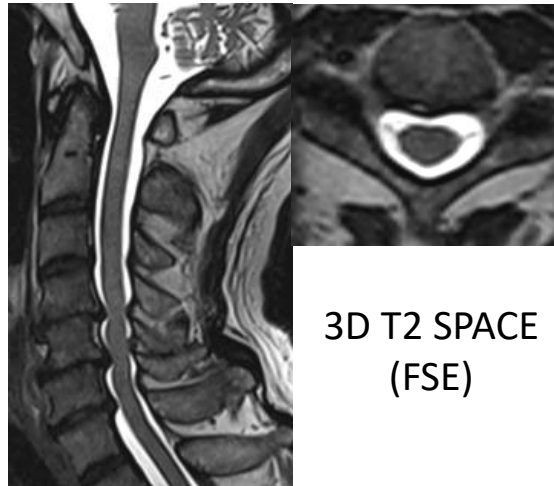
▪ The development of 3D MRI has allowed MPR visualization and to be acquired thin slice and fine images. Although 3D sequences have historically been based on GRE(Gradient Echo) techniques(FIESTA, True FISP, etc), the advent of FSE(Fast Spine Echo) 3D sequences, such as The 3D T2 sampling perfection with application-optimized contrasts by using flip angle evolution (3D T2-SPACE sequence; Siemens), affords a potential produces images with higher resolutions and visualization. There was a few reports investigating their value directly compared GRE 3D MRI sequences with FSE 3D sequences in cervical spine. In this study, we evaluated the visualization ability of the 3D T2-SPACE sequence in the cervical spine.

Objective

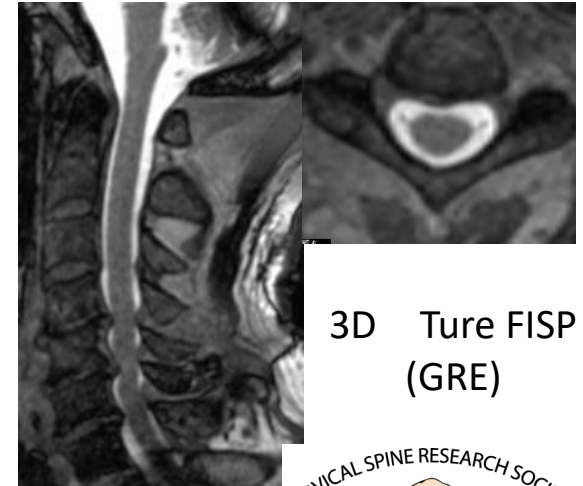
To reveal the efficacy of the 3D T2-SPACE sequences compared with True FISP sequences.



Conventional
2D T2WI
(SE)



3D T2 SPACE
(FSE)



3D True FISP
(GRE)

Title Efficacy of the 3D T2-SPACE sequences compared with the GRE 3D MRI

Materials

- This study included 15 patients (11 male and 4 female patients)
- Mean age,64.2[38-84]years who were admitted to our hospital with cervical spine lesions and wereimaged with TrueFISP and 3D T2-SPACE between April 2019 and December 2019.
- We use 3.0T MRI(Siemens MAGNETOM Skyra), and the MR imaging parameters are as follows.

sampling	TR(ms)	TE(ms)	AVE	FOV	Slice (mm)	Voxel size	Base resolution	Band width
3D T2-SPACE 5m31sec								
sagittal	1400	95	1.4	250mm	0.8	0.83*0.78*0.8	301*320	601 Hz/pix
Ture FISP 3m41sec								
sagittal	272	1.8	1.0	240mm	0.9	0.94*0.75*0.9	256*320	625 Hz/pix

Methods

- The contrast-to-noise ratio (CNR) was used to objectively evaluate these quality.
- Using the CNR in sagittal 3D True FISP and 3D T2-SPACE images, we assessed the visibility of anatomical structures by comparing the spinal cord, vertebral body, intervertebral disc, posterior longitudinal ligament, fat, and muscle with cerebrospinal fluid(CSF).
- We used the EU-proposed method¹⁾ for calculating the CNR and paired t-tests for statistical analysis.
- The higher the CNR, the better the contrast and the greater the image.

【SPACE】



【TrueFISP】



Sa ○ : signal of CSF

Sb ○ : signal of tissue

SDa : standard deviation of CSF

SDb : standard deviation of tissue



$$\text{CNR} = \frac{|S_a - S_b|}{\sqrt{(SD_a^2 + SD_b^2)/2}}$$

Results 1

The 3D T2-SPACE sequence had a higher CNR than that of the Ture FISP sequence ($p < 0.01$) in spinal code, fat, muscle, and posterior longitudinal ligament.

	3D T2-SPACE	True FISP	P Value
Spinal code	87.63	47.51	<0.01
Posterior longitudinal ligament	87.64	47.51	<0.01
Subcutaneous fat	36.51	15.66	<0.01
Semispinalis cervicis muscle	119.20	65.32	<0.01
Vertebral body	72.51	52.26	P<N.S
Intervertebral disc	71.87	47.33	P<N.S

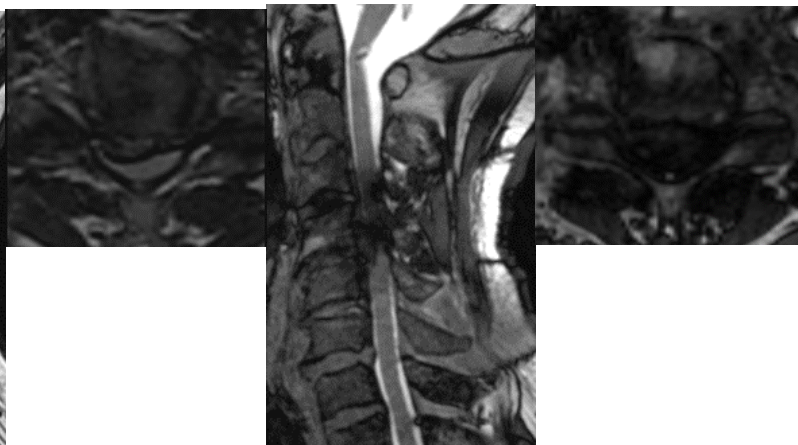
Results 2

The 3D T2-SPACE sequence showed fewer cerebrospinal fluid flow artifacts. Severe artifacts were seen at the most stenotic site.

【SPACE】



【TrueFISP】



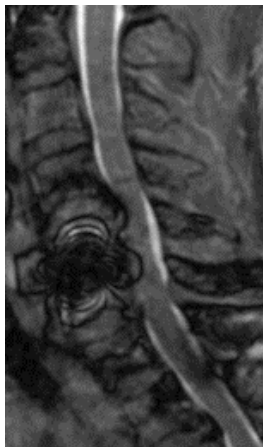
【X-ray】



【SPACE】



【TrueFISP】



Also, the 3D T2-SPACE sequence showed fewer magnetic susceptibility artifacts.

Discussion

- 3D T2-SPACE is a sequence that changes the Flip angle over time to obtain good contrast while reducing SAR(specific absorption rate).

- $SAR \propto \sigma r^2 B_0^2 \alpha^2$

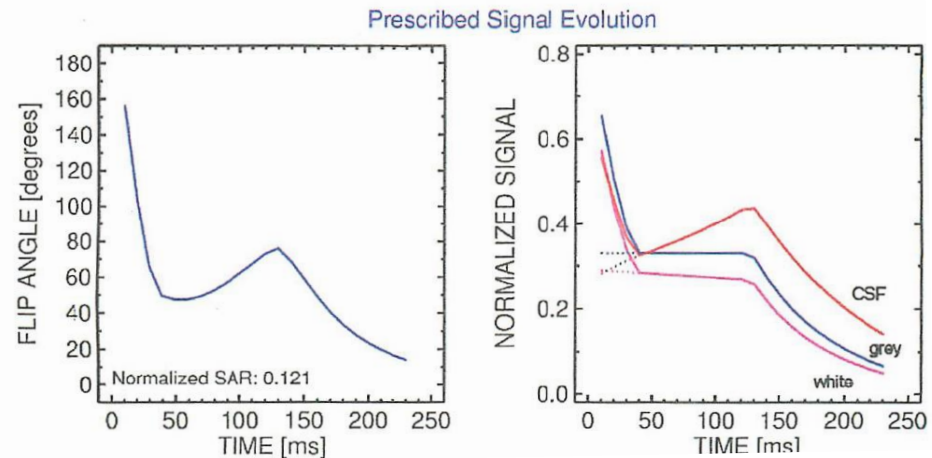
r ; radius

σ ; electrical conductivity ; radius

B_0 ; Static magnetic field strength

α ; Flip angle

SAR is proportional to the square of Flip angle²).



Conclusion

The 3D T2-SPACE sequence had a higher CNR compared with that of the TrueFISP sequence, which provided excellent visibility. The 3D T2-SPACE sequence compensates for the disadvantages of the 3D GRE sequence.

Acknowledgements

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