

:
 :
 10 3.0 T
 Stejskal - Tanner
 EPI . b - value 1000 s/mm²
 가 6 , 11 , 23 , 35 47
 가
 (FA) . FA 가
 FA FA
 : 가 6 47 가
 가 가 FA
 가 FA
 : 가 가 FA
 FA
 (1, 2).
 가
 (VR: volume ratio),
 (RA: relative anisotropy) (FA:
 fractional anisotropy)
 가
 가
 6
 (3, 4).
 6

1
 2
 3
 4
 2002 - 2002 (KRF - 22)
 2004 11 8 -D00476). 2005 1 10
 T2 (5 , 5 , 3.0 T
 (Signa VHi, GE Medical, U.S.A.)

Stejskal - Tanner type
single - shot EPI
b -
value=1000 s/mm², TR/TE=8000/71 ms, Matrix=128 ×
128, slice thickness/spacing=5/2 mm, FOV=220 mm,
NEX=1
11 , 23 , 35 47
6
56 , 47 6 25 가
가
(Advantage Window, GE,
EPI
U.S.A.)
FA
FA
FA
10
가 6 47 가
47 1
가 가 가 6
(Fig.
1).
FA
Fig. 2

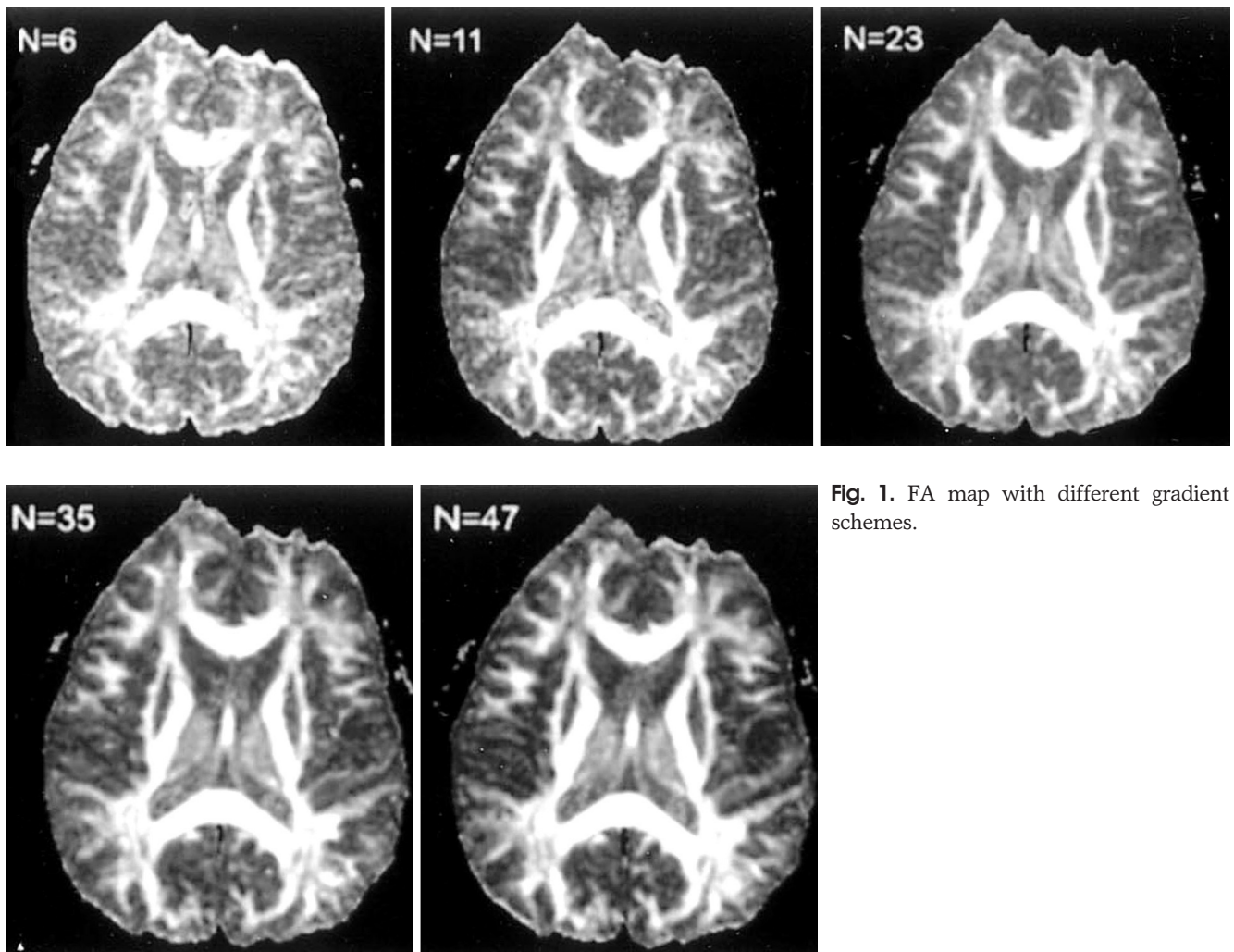


Fig. 1. FA map with different gradient schemes.

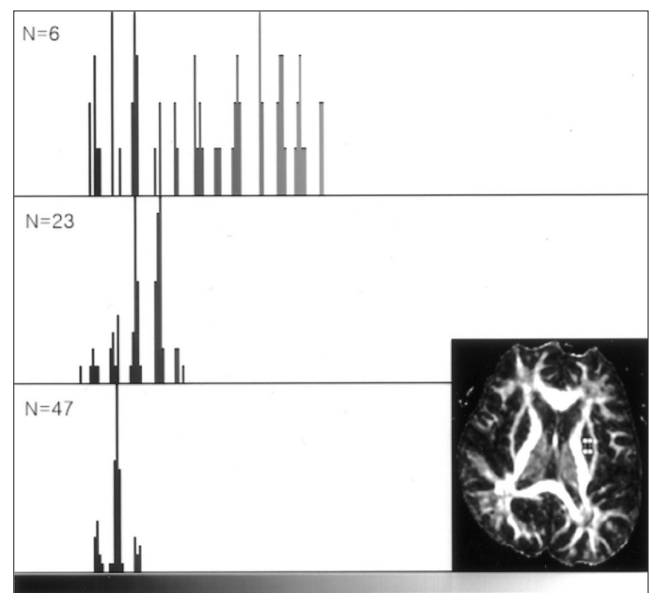
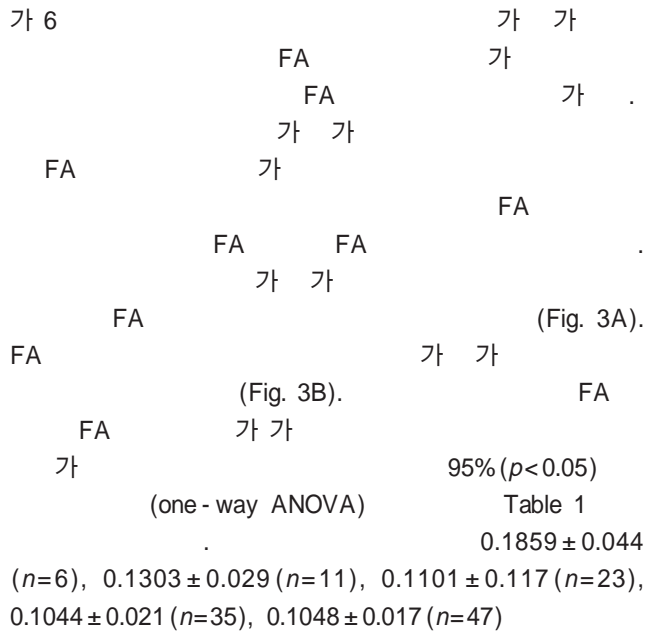


Fig. 2. ROI and histogram analysis on FA map.

Table 1. Fractional Anisotropy and Standard Deviation of Fractional Anisotropy on Different Diffusion Tensor Imaging Schemes ($p < 0.05$)

Region of Interest		Number of Gradient Direction					p-value
		n = 6	n = 11	n = 23	n = 35	n = 47	
Frontal gray matter	Mean	0.1859	0.1303	0.1101	0.1044	0.1048	0.00000004
	SD	0.044	0.029	0.017	0.021	0.017	
Putamen	Mean	0.1737	0.1343	0.1151	0.1040	0.101	0.00000068
	SD	0.036	0.025	0.023	0.027	0.017	
Posterior limb internal capsule	Mean	0.7544	0.7145	0.7206	0.7115	0.6947	0.03313136
	SD	0.053	0.042	0.036	0.033	0.035	
Corpus callosum splenium	Mean	0.8155	0.8099	0.7979	0.7933	0.7701	0.23943359
	SD	0.061	0.040	0.042	0.046	0.039	

SD: Standard Deviation

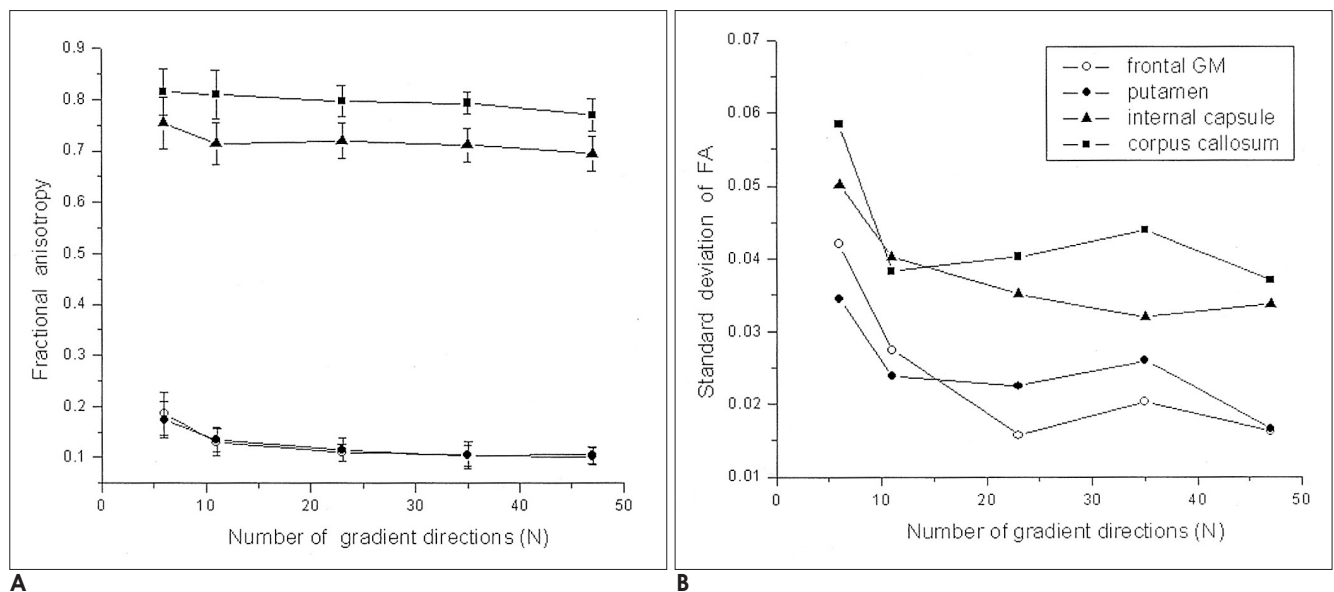


Fig. 3. The mean FA (**A**) and the standard deviation of FA (**B**) for different gradient schemes.

:
 $p < 0.05$
 가
 . FA FA
 가 가
 FA 가
 가 가
 .
 (5, 6).
 6 가
 가 6
 .
 가
 (principal axis)
 (eigen vector) 가
 3
 (fiber tractography) (artifact)
 (7). 가 23 가 FA
 FA
 가
 6 가 , FA
 가 6 23 가
 가 23
 가 23 가
 가
 가
 (8).
 (NEX) 가 가 23 가
 .
 가
 (9, 10).
 SVD (singular value decom-
 position) , 가
 6 가 가 FA
 6 가 가 FA
 가 가
 가 FA
 (single self - diffusion) 가
 (single tensor model) 가 가
 가
 가
 (multiple tensor model)
 (11). 가
 가

가

가

23

가

가

가

가

Echo

Planar Imaging (EPI)

. EPI

parallel imaging PROPELLER (periodically rotated overlapping parallel lines with enhanced reconstruction)

(12).

가

가

가

가

가

FA

가 가

가 23

가

FA

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Histogram Analysis of Noise Performance on Fractional Anisotropy Brain MR Image with Different Diffusion Gradient Numbers¹

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Purpose: We wished to analyze, qualitatively and quantitatively, the noise performance of fractional anisotropy brain images along with the different diffusion gradient numbers by using the histogram method.

Materials and Methods: Diffusion tensor images were acquired using a 3.0 T MR scanner from ten normal volunteers who had no neurological symptoms. The single-shot spin-echo EPI with a Stejskal-Tanner type diffusion gradient scheme was employed for the diffusion tensor measurement. With a b-value of 1000 s/mm², the diffusion tensor images were obtained for 6, 11, 23, 35 and 47 diffusion gradient directions. FA images were generated for each DTI scheme. The histograms were then obtained at selected ROIs for the anatomical structures on the FA image. At the same ROI location, the mean FA value and the standard deviation of the mean FA value were calculated.

Results: The quality of the FA image was improved as the number of diffusion gradient directions increased by showing better contrast between the WM and GM. The histogram showed that the variance of FA values was reduced as the number of diffusion gradient directions increased. This histogram analysis was in good agreement with the result obtained using quantitative analysis.

Conclusion: The image quality of the FA map was significantly improved as the number of diffusion gradient directions increased. The histogram analysis well demonstrated that the improvement in the FA images resulted from the reduction in the variance of the FA values included in the ROI.

Index words : Brain, MR

Magnetic resonance (MR), diffusion

Magnetic resonance (MR), pulse sequence

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