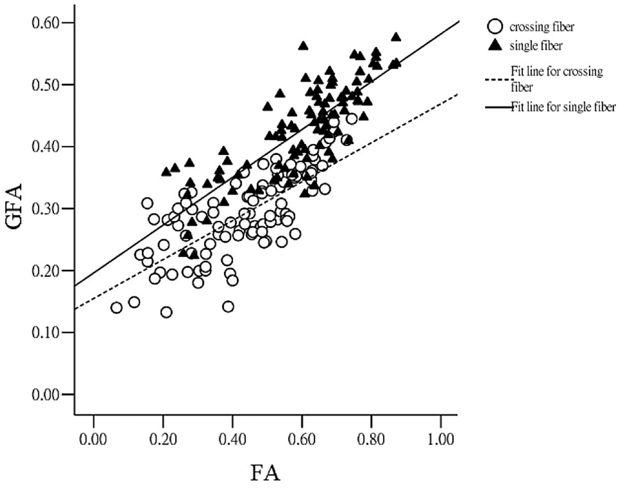
ON-LINE APPENDIX

According to the definition of Basser and Pierpaoli,[1] fractional anisotropy (FA) is calculated from the eigenvalues, λ1, λ2, and λ3, of the diffusion tensor:

$$FA = \frac{\sqrt{3}}{\sqrt{2}} \; \frac{\sqrt{(\lambda - \lambda)^2 + (\lambda_0 - \lambda)_2 + (\lambda_3 - \lambda)^2}}{\sqrt{\lambda_1^2 + \lambda_2^2 + \lambda_3^2}},$$

where λ is the mean diffusivity. When the same concept is applied to the calculation of anisotropy of the orientation distribution function, the generalized FA (GFA) is defined as: GFA = s.d.(ODF) / r.m.s.(ODF), where s.d. is the SD and r.m.s. is the root mean square of the orientation distribution function values. According to the reports of Fritzsche et al[2] and Gorczewski et al,[3] GFA derived from high-angular-resolution diffusion imaging was mostly linear but lower than the FA. To demonstrate that this is also true in DSI, we analyzed DSI datasets in 10 healthy male subjects and investigated the correlation between GFA and FA. The single-fiber region (10 voxels of the genu of the corpus callosum) and the crossing-fiber region (12 voxels of the retrolenticular part of the left internal capsule) were selected on the same anatomic landmarks of each participant. We reconstructed diffusion data using DSI and DTI reconstruction methods and calculated GFA and FA, respectively, in each of the single-fiber and crossing-fiber regions. We found that GFA was indeed lower than FA in both single-fiber and crossing-fiber regions. The significantly positive correlation between the GFA and the FA was found in the single-fiber (Pearson $r = .810$; $P < .001$) and crossing-fiber regions (Pearson $r = .757$; $P < .001$) (see Figure).



REFERENCES

1. Basser PJ, Pierpaoli C. **Microstructural and physiological features of tissues elucidated by quantitative-diffusion-tensor MRI.** *J Magn Reson B* 1996;111:209–19
2. Fritzsche KH, Laun FB, Meinzer HP, et al. **Opportunities and pitfalls in the quantification of fiber integrity: what can we gain from Q-ball imaging?** *Neuroimage* 2010;15:242–51
3. Gorczewski K, Mang S, Klose U. **Reproducibility and consistency of evaluation techniques for HARDI data.** *MAGMA* 2009;22:63–70