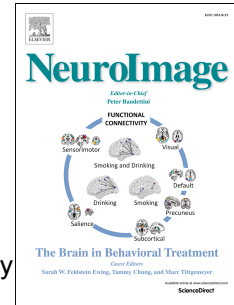


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Stability and reproducibility of co-electrospun brain-mimicking phantoms for quality assurance of diffusion MRI sequences

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Abstract

Grey and white matter mimicking phantoms are important for assessing variations in diffusion MR measures at a single time point and over an extended period of time. This work investigates the stability of brain-mimicking microfibre phantoms and reproducibility of their MR derived diffusion parameters. The microfibres were produced by co-electrospinning and characterized by scanning electron microscopy (SEM). Grey matter and white matter phantoms were constructed from random and aligned microfibres, respectively. MR data were acquired from these phantoms over a period of 33 months. SEM images revealed that only small changes in fibre microstructure occurred over 30 months. The coefficient of variation in MR measurements across all time-points was between 1.6% and 3.4% for MD across all phantoms and FA in white matter phantoms. This was within the limits expected for intra-scanner variability, thereby confirming phantom stability over 33 months. These specialised diffusion phantoms may be used in a clinical environment for intra and inter-site quality assurance purposes, and for validation of quantitative diffusion biomarkers.

Highlights

- Grey and white matter mimicking phantoms showed mean diffusivity and fractional anisotropy values typical of tissue.
- Diffusion measures for the phantoms were stable over 33 months.
- The porosity of the phantoms was observed to be stable over 30 months.
- The phantoms may be used for QA purposes in a clinical environment and for validation of quantitative diffusion biomarkers.

Keywords

Diffusion MRI, brain phantom, hollow microfibers, co-electrospinning, white matter phantom, gray matter phantom

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