

Diffusion basis spectrum imaging

Diffusion basis spectrum imaging, is capable of characterizing water diffusion properties associated with axon/myelin injury and inflammation.

It was developed to quantitatively reveal white matter pathologies in central nervous system disorders. Tissue phantoms made of normal fixed mouse trigeminal nerves juxtaposed with and without gel were employed to demonstrate the feasibility of diffusion basis spectrum imaging to quantify baseline cellularity in the absence and presence of vasogenic oedema. Following the phantom studies, in vivo diffusion basis spectrum imaging and diffusion tensor imaging with immunohistochemistry validation were performed on the corpus callosum of cuprizone treated mice. Results demonstrate that in vivo diffusion basis spectrum imaging can effectively separate the confounding effects of increased cellularity and/or grey matter contamination, allowing successful detection of immunohistochemistry confirmed axonal injury and/or demyelination in middle and rostral corpus callosum that were missed by diffusion tensor imaging. In addition, diffusion basis spectrum imaging-derived cellularity strongly correlated with numbers of cell nuclei determined using immunohistochemistry.

The findings suggest that diffusion basis spectrum imaging has great potential to provide non-invasive biomarkers for neuroinflammation, axonal injury and demyelination coexisting in multiple sclerosis ¹⁾.

DBSI quantified axonal loss may be an imaging biomarker to predict functional recovery following decompression in cervical spondylotic myelopathy. The results demonstrate an increase of about 60% in the odds of impairment relative to the control for each decrease of 100µL in axon volume ²⁾.

¹⁾

Wang Y, Wang Q, Haldar JP, Yeh FC, Xie M, Sun P, Tu TW, Trinkaus K, Klein RS, Cross AH, Song SK. Quantification of increased cellularity during inflammatory demyelination. *Brain*. 2011 Dec;134(Pt 12):3590-601. doi: 10.1093/brain/awr307. PubMed PMID: 22171354; PubMed Central PMCID: PMC3235568.

²⁾

Murphy RK, Sun P, Xu J, Wang Y, Sullivan S, Gamble P, Wagner J, Wright NN, Dorward IG, Riew D, Santiago P, Kelly MP, Trinkaus K, Ray WZ, Song SK. Magnetic Resonance Imaging Biomarker of Axon Loss Reflects Cervical Spondylotic Myelopathy Severity. *Spine (Phila Pa 1976)*. 2015 Dec 8. [Epub ahead of print] PubMed PMID: 26650876.

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