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**Attempting Magnetic Resonance Imaging Visualization of
Juxtacortical Neurodegeneration in Patients with Multiple Sclerosis**

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Multiple sclerosis is a neuro-inflammatory and neurodegenerative disease of the central nervous system. Histopathologic findings show an increase in cell stress and death related genes in cortical neurons within supragranular layers. Their selective damage might at least partially link to pathologic changes in connected juxtacortical white matter.

The current study examined whether juxtacortical fibers are reduced in the context of changes that occur in the cortex, in vivo based on magnetic resonance imaging scans in patients with multiple sclerosis. For this purpose, magnetic resonance images of 70 multiple sclerosis patients were acquired at 3 Tesla at two time points. A patient with cortical and juxtacortical signaling abnormalities in one hemisphere and no pathological findings in the other hemisphere was selected as a pathological control to interrogate the methods applied.

Four different imaging analysis approaches such as i) Advanced Normalization Tools, ii) Human Connectome Project pipeline, iii) Voxel-Guided Morphometry and Morphometric and iv) Junction Imaging Analysis were utilized focusing on established cortical metrics to find indirect or direct indicators for juxtacortical pathology.

Despite its proven high sensitivity to segment and/or detect volumetric and focal changes in multiple sclerosis those analysis approaches were unable to detect juxtacortical changes convincingly. Despite careful planning, a meaningful MS patient cohort and the expected results in relation to lesion detection, all approaches presented negative results in relation to juxtacortical abnormality detection. Particularly the results obtained by the voxel-guided morphometry analysis point to the possibility that the biological changes we were searching for are either minimal or not detectable by current magnetic resonance imaging resolution and analysis techniques. Further research should focus on new approaches to investigate this lesion site taking the possibly small scale of pathological changes into consideration.