Composite MRI scores improve correlation with EDSS in multiple sclerosis.

**Abstract**

**BACKGROUND:** Quantitative measures derived from magnetic resonance imaging (MRI) have been widely investigated as non-invasive biomarkers in multiple sclerosis (MS). However, the correlation of single measures with Expanded Disability Status Scale (EDSS) is poor, especially for studies with large population samples.

**OBJECTIVE:** To explore the correlation of MRI-derived measures with EDSS through composite MRI scores.

**METHODS:** Magnetic resonance images of 126 patients with relapsing-remitting MS were segmented into white and gray matter, cerebrospinal fluid, T2-hyperintense lesions, gadolinium contrast-enhancing lesions, T1-hypointense lesions ('black holes': BH). The volumes and average T2 values for each of these tissues and lesions were calculated and converted to a z-score (in units of standard deviation from the mean). These z-scores were combined to construct composite z-scores, and evaluated against individual z-scores for correlation with EDSS.

**RESULTS:** Composite scores including relaxation times of different tissues and/or volumetric measures generally correlated more strongly with EDSS than individual measures. The maximum observed correlation of a composite with EDSS was $r = 0.344$ ($p < 0.0001$), which is an improvement over the highest-performing single
MRI measure (BH; r = 0.298, p < 0.001).

**CONCLUSION:** Z-transformation permits construction of composite scores including volumetric and T2-relaxation measures. Inclusion of multiple MRI measures in the composite can provide a broader characterization of the disease process, resulting in more robust correlations with EDSS.

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