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White matter correlates of complex processing speed performance in relapsing-remitting multiple sclerosis.

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Background: Slowed processing speed (PS) is the cognitive deficit most commonly reported in people with multiple sclerosis (MS). PS is influenced by demyelination processes that characterise MS pathology and cause breakdown in neural transmission. The association between PS performance and degeneration of specific white matter (WM) tracts in MS patients has not been clarified yet. The current literature, mainly comprising exploratory studies, has highlighted variable and inconsistent results.

Objectives: This study investigated the differential relationships between WM microstructural integrity and complex PS performance on common tests, and the influence of PS on higher order cognition and WM integrity in relapsing-remitting MS (RRMS).

Methods: Twenty-nine RRMS patients (Expanded Disability Status Scale ≤ 6 , age = 44.1 ± 9.2 , disease duration = 8.9 ± 6.2) were recruited. The whole sample underwent neuropsychological and magnetic resonance (MR) diffusion tensor imaging (DTI) assessments. Tract-based spatial statistics (TBSS) was used to correlate DTI indices with cognitive performance on: different versions of the Paced Auditory Serial Addition Test (PASAT), the Digit Symbol Coding (DSC) test, and both PS-dependent and PS-independent neuropsychological tests. A new PS difference score (PASAT 3s – PASAT 1.5s) was additionally investigated.

Results: Correlations with DTI indices were detected for the DSC and the PS difference score while neither the PASAT versions nor the higher order tests were associated with WM integrity. The anterior corpus callosum and bilateral fronto-parietal associative tracts were the main structures involved in PS performance.

Conclusions: Associative and callosal WM fibres, mainly connecting frontal areas, seem to be the neural correlate of abnormal PS performance in this form of MS. These findings highlight for the first time clearly that this association is crucial for timed tasks depending on the visual modality, challenging for MS patients, or when more elaborate indices, i.e. PS difference score, are used.