Effect of Cigarette Smoking and Alcohol Use on White Matter Tract Integrity

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Background
Cigarette smoking (CS) is highly comorbid with alcohol use disorder (AUD). Both are associated with lower white matter (WM) integrity, with potentially additive effects. This study is a starting point to determine the individual and combined effects of CS and AUD on WM integrity.

Methods
Thirty subjects with varying CS and alcohol use (40.0 ± 12.9 years, 13 females, 17 males) underwent structural (T1-weighted) and diffusion weighted magnetic resonance imaging. Indices of WM integrity, fractional anisotropy (FA) and mean diffusivity (MD), were calculated at a voxel-wise level. Parametric maps of FA and MD were spatially normalized to Montreal Neurological Institute space. Average FA and MD values were extracted for 48 WM tracts from the Johns Hopkins University WM tract atlas.

Alcohol drinking and CS were characterized by: DSM-5 AUD symptom checklist, Obsessive Compulsive Drinking Scale (OCDS, including obsessive and compulsive subscales), Timeline Followback (TLFB; drinks/drinking day and drinks/week), Alcohol Use Disorders Identification Test (AUDIT), Fagerstrom Test for Nicotine Dependence (FTND), self-reported pack years, and cigarettes/day. Linear regression was performed between FA and MD with alcohol and CS metrics.

Results
We found significant negative correlations ($p<0.01$) between bilateral cingulate gyri FA and total OCDS score and subscales, drinks/drinking day, drinks/week, and AUDIT. Right inferior cerebellar peduncle FA was negatively correlated with FTND and cigarettes/day. Bilateral superior cerebellar peduncle MD was positively correlated with FTND and cigarettes/day. Left cingulate hippocampus MD was positively correlated with OCDS compulsivity.

Conclusion
Alcohol use was negatively correlated with cingulate gyrus WM FA, which is implicated in goal-directed behavior and salience attribution. CS was negatively correlated with cerebellar peduncle FA; however, the interpretation of this is unclear. Our results support the hypothesis that both CS and AUD negatively impact WM integrity. Future work will determine the potentially additive effects of smoking and alcohol use.