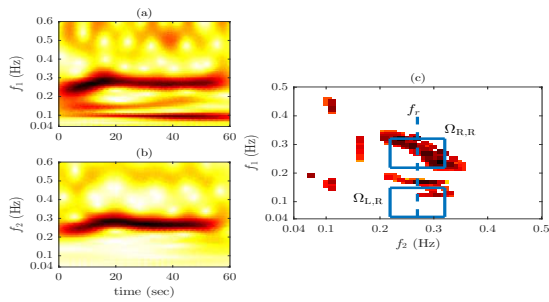


Blunted Autonomic Reactivity to Mental Stress in Depression Quantified by Nonlinear Cardiorespiratory Coupling Indices

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In this study, differences in autonomic reactivity to mental stress between Major Depressive Disorder (MDD) patients and healthy control (HC) subjects are assessed by nonlinear cardiorespiratory coupling indices derived from the Real Wavelet Biphase. The degree and strength of Quadratic Phase Coupling (QPC) between interacting oscillations of Heart Rate Variability (HRV) and respiration are quantified before, during and after the execution of a cognitive task. Results show that the QPC strength and QPC degree between the respiration and the respiratory sinus arrhythmia component of HRV were lower in HC compared to MDD during stress, suggesting that the parasympathetic branch was less inhibited in MDD patients. During recovery, only in HC group, this degree of QPC increased, while the respiratory rate was reduced, compared to the basal stage. The degree of QPC between the respiration and components of HRV in the low frequency band ($[0.04, 0.15]$ Hz) increased in HC during stress, compared to the basal stage, while remained unchanged in MDD patients. These results imply that depression is associated with blunted autonomic reactivity to mental stress.



QPC assessment in the regions related to respiration. The Continuous Wavelet Transform amplitude coefficients of (a) HRV, (b) respiration, and (c) Real Wavelet Biphase domain. The respiratory rate f_r is marked with a dashed blue line. QPC between respiration and components of HRV in the low frequency band is assessed in $\Omega_{L,R}$ while between respiration and respiratory sinus arrhythmia component of HRV is assessed in $\Omega_{R,R}$.