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EVALUATION OF LOWER LIMB CROSS PLANAR KINETIC CONNECTIVITY SIGNATURES POST STROKE

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Given the abnormal swing kinematics of hemiparetic gait, we assess the neuromechanical impairments that constrain the ability to control individual degrees of freedom. The goal of this study was to comprehensively quantify cross planar torque coupling patterns across multiple non-neighboring lower limb joints during an isometric torque target matching task. We propose that characteristic patterns of covariance between cross planar multi joint torque couplings in the post stroke lower limb reflect underlying neurophysiological impairments governing abnormal kinetic output. We use principle component analysis to extract prominent interdependent features of lower limb joint torque patterns that account for the variance of the aggregate kinetic signatures across each population. We find that common features of cross planar connectivity in the pathological state include robust frontal to sagittal plane kinetic coupling that overlay a common sagittal plane coupling in healthy subjects. Such coupling persists independent of proximal or distal joint control and limb biomechanics. Principle component analysis of the aggregate kinetic signature for stroke further reveals unique abnormal frontal plane coupling features that explain a larger percentage of the total torque coupling variance. Figure 1 represents a visual integrated summary of the statistically significant ($p < 0.05$) differences between the kinetic coupling patterns of stroke and control subjects. Each i,j^{th} entry corresponds to primary to secondary torque generation normalized to MVC. Diagonal values indicate the ratio of stroke to control MVC. These mechanics may potentially be reflective of impaired neural outflow that constrains the ability to perform biomechanical tasks essential for locomotion.

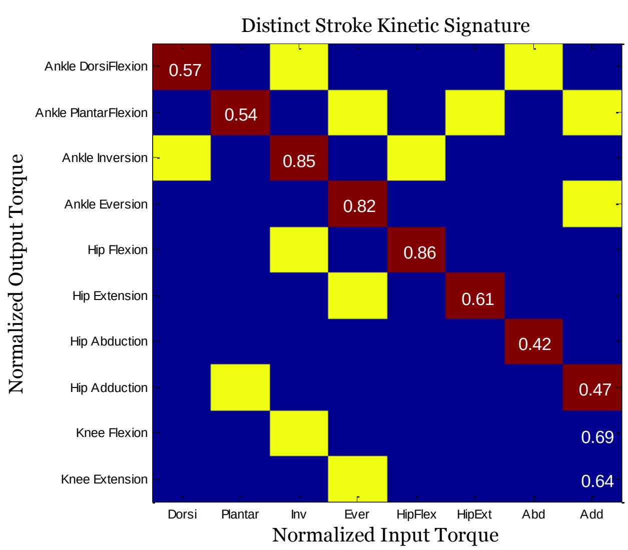

Figure 1: Between population 3-D kinetic coupling pattern. Each yellow highlighted i,j^{th} entry corresponds to statistically significant difference ($p < 0.05$) in secondary torque production between stroke and control subjects. Diagonal values indicate the ratio of stroke to control MVC.