Relationship Between Control Parameters Representing Gait in Parkinson's Disease and Clinical Measures

Parkinson's disease is a neurodegenerative disorder in which patients frequently exhibit gait impairments. Understanding how these impairments relate to commonly used clinical measures provides valuable insights for determining effective rehabilitation strategies.

We addressed this issue using musculoskeletal simulation. Specifically, we fitted a musculoskeletal model and a neural control model to gait data obtained from PD patients. We then analyzed the relationship between the resulting control parameters and clinical measures recorded for the same individuals. As a result, we identified subsets of control parameters that were correlated with specific clinical measures. These findings suggest that different motor impairments—quantified through clinical evaluations—may be characterized by distinct sets of control parameters. Furthermore, we formulated these relationships using a linear regression model and successfully estimated control parameters from clinical measures alone, allowing us to simulate patient-specific gait patterns through musculoskeletal simulation.

In the future, it may become possible to estimate or even predict gait impairments solely based on clinical measures. Conversely, it may also be feasible to infer the severity of motor impairments from observed gait patterns.
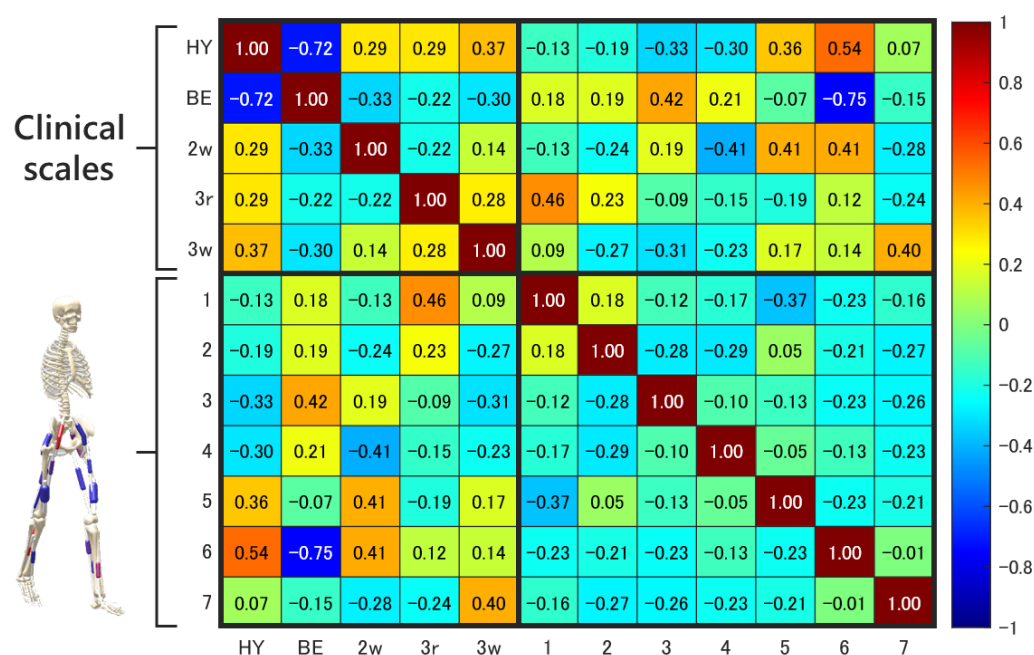

Fig 1. Correlations between clinical scores and dimensionally-reduced control parameters.

Keywords: Postural Control, Parkinson's Disease, Gait, Musculoskeletal Model

References

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