

Analysis of Gait Patterns and Balance Impairments as Digital Biomarkers According to Disease Severity in Parkinson's Disease

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Danyeong Kim^{1,2}, Da-Eun Jeong¹, Min Ju Kang¹

¹ Veterans Health Service Medical Center, Seoul, Korea

² Department of Bionano Technology, Gachon University, Seongnam, Korea



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INTRODUCTION

Gait impairment is characterized in Parkinson's disease (PD), such as shortened stride length and higher cadence. While previous studies have examined conventional gait parameters, they limit subdivide complexes and severity in PD patients. This study investigates advanced conventional and novel gait parameters according to differentiation of disease severity.

METHODS

PD patients (n=49) and healthy controls (HC, n=32) assessed gait parameters using MOCO/Motioncore (JEIOS Inc.). The groups measured 10-meter walk and Timed Up and Go tests. PD severity was assessed using the Hoehn & Yahr (H&Y) scale.

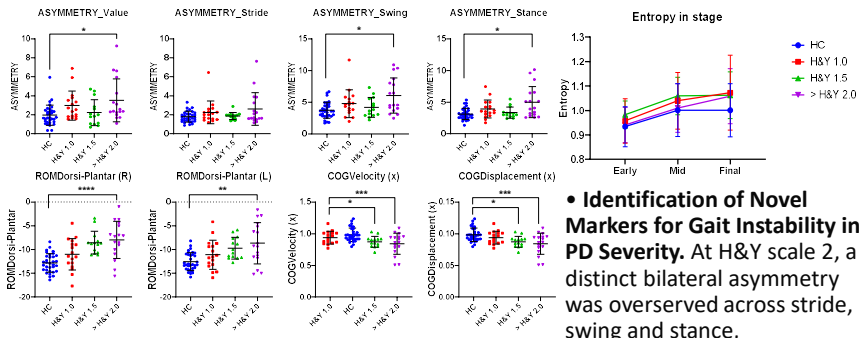
RESULTS

Demographic and Clinical Characteristics of Participants by Diagnostic Group.

- There were no significant differences in sex distribution between groups. In age, there are differences.

RESULT

- Imbalance and instability according PD severity.** Progression along the H&Y scale was marked by significant reduction in stride length and single support duration. Conversely, PD patients exhibited a compensatory increase in double support time to mitigate gait instability.

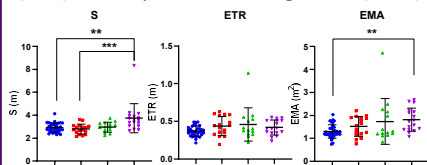


alongside a significant expansion in ankle range of motion (ROM). In severity, the center of mass (COM) displacement was markedly attenuated. Gait entropy in PD patients increased rapidly as the test progressed.

RESULTS

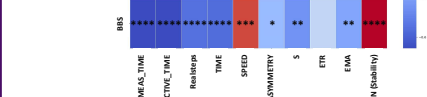
RESULTS

- Decreasing turning stability in PD severity.** Turning performance also deteriorated with disease severity, characterized by protracted initiation distances (S), broader turning radius (RTR) and expanded turning areas (EMA).



- Significant correlation between clinical information and gait parameters.** Gait parameters, especially turning, significantly correlates with worse clinical severity: it shows a strong positive correlation with H&Y, UPDRS,

and FOG-Q, and a strong negative correlation on with BBS and K-MMSE.



CONCLUSIONS

This study demonstrates that gait instability in PD is closely correlated with disease severity. Beyond basic parameters like stride length, increased asymmetry, altered ankle kinematics, reduced COM displacement, and higher gait entropy serve as critical indicators of heightened gait irregularity and instability. The reduction in gait in turning deficits further underscores the functional decline in PD patients. These comprehensive gait metrics showed statistical significance across H&Y stages, suggesting their potential as digital biomarkers for monitoring disease progression and assessing clinical status.

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