Gait analysis in different conditions and relationships between balance and strength in people with Parkinson's

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Summary

We investigated differences in gait speeds (self-selected, maximum, and dual-task – DT) in people with Parkinson's disease (PD) and analyzed how dynamic balance, static balance, and lower limb strength (LLS) influence these conditions. Twenty-nine individuals with PD were assessed for static balance with eyes open (EO) and closed (EC), dynamic balance, LLS, and different gait conditions using the 10-meter walk test. The results showed significant differences between gait conditions ($p<0.001$), with a reduction in speed during DT. LLS and static balance were positively correlated with gait, while dynamic balance showed a negative correlation. The study highlights the importance of developing strength and balance to improve gait and functional mobility in PD.

Introduction

Gait is a key marker for monitoring motor and non-motor changes in Parkinson's disease (PD). As PD progresses, varying locomotion speed and performing dual tasks (DT) become increasingly challenging, affecting safety and mobility. Spatiotemporal gait parameters, such as speed, step length, and double support time, are negatively impacted, especially under cognitive or motor loads [1, 2]. Balance and lower limb strength (LLS) are crucial for propulsion and postural control, particularly in DT scenarios [3]. This study aimed to examine gait speed differences (self-selected, maximum, and DT) in individuals with PD and assess how balance and LLS influence these conditions.

Methods

This cross-sectional study analyzes baseline data from a clinical trial at the "Reference Center for Aging and Movement" in Brazil. Twenty-nine PD patients (68.2±11.1 years, 15 men), were included, with Hoehn and Yahr stages 1 to 3. Exclusion criteria: deep brain stimulation and ambulatory limitations. Static balance was assessed using a force platform in a unipedal stance (EO and EC), and dynamic balance with the Timed Up and Go test. LLS was measured via the 30-second sit-to-stand test. Gait was evaluated using the 10-meter walk test (SSS, MS, and DTS). Student's t-test analyzed gait condition differences, and Pearson's correlation coefficient assessed gait, balance, and LLS correlations.

Results and Discussion

The results showed an SSS of 1.07±0.26 m/s, MS of 1.43±0.39 m/s, and DTS of 0.92±0.28 m/s, with statistically significant differences among all gait conditions ($p<.001$; Table 1). These findings indicate that each condition distinctly affects spatiotemporal parameters, especially in DT, supporting studies that associate this reduction with cognitive decline [2].

In the correlations between functional outcomes (Figure 1), LLS showed a significant positive correlation with SSS ($r = .463$; $p = .015$) and MS ($r = .607$; $p < .001$). Static balance with EO showed a positive correlation with all three gait conditions, also in the EC condition. Dynamic balance showed a significant negative correlation with all three gait conditions. These results align with the literature, which highlights physical variables as indicators of disease progression and influential factors in the quality of life of people with PD [3].

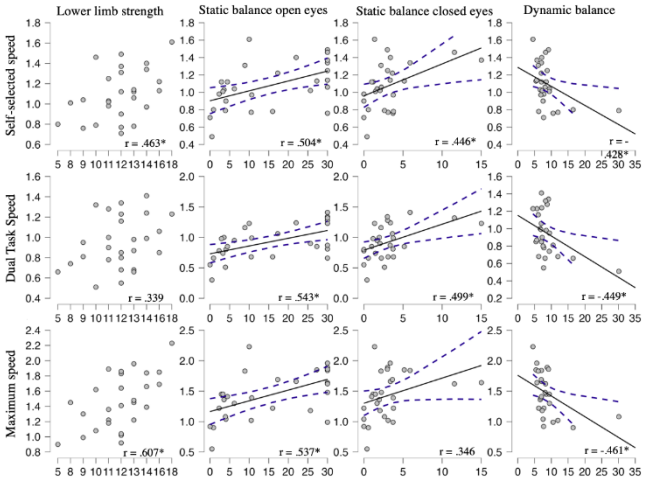

Figure 1: Correlations among the studied variables. Speeds in meters per second, strength in repetitions performed, balance in seconds; *: $p < .050$, r: Pearson's correlation coefficient.

Conclusions

Different gait conditions, especially in the presence of TD, significantly impact the mobility of individuals with PD. LLS and balance play fundamental roles in the functional performance of locomotion, particularly in challenging situations such as MS and DTS. These results highlight the importance of health professionals considering different aspects of the functional mobility of individuals with PD.

References

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