Freezing of gait in Parkinson’s disease and the role of postural control impairments

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Background and aim: Patients with Parkinson’s disease (PD) increasingly show postural control impairments with disease progression. Moreover, up to 80% of patients develop freezing of gait (FOG). Despite the fact that freezing is a predictor of falling, the relationship between a specific postural control deficit and FOG is unknown. Therefore, we investigated a number of postural control measures that could potentially discriminate between freezers and non-freezers in PD.

Methods: 46 PD patients (H&Y 2-3) and 20 healthy controls were included. 14 patients were identified as freezer (FR) and 32 as non-freezer (NFR) based on the nFOGQ and verified by observations during examination. All groups were matched for age and PD subgroups for MDS-UPDRS III (OFF) scores and disease duration. The clinical Mini-BESTest (total and subscores) was used to assess static and dynamic balance. In addition, static balance was investigated by single leg stance (SLS) duration and sway parameters during SLS and double support tasks using the VICON 3D-motion analysis system and force plates. Double leg stance was captured for periods of 20 seconds on a firm and foam surface with eyes open and closed. Sway parameters of the center of pressure (COP) in both medio-lateral (ML) and anterior-posterior (AP) directions were investigated. Non-parametric statistics were used to compare Mini-BESTest scores and SLS durations. One-way ANOVA was used to investigate postural sway parameters during single and double support conditions.

Results: The total score on the Mini-BESTest tended to be (p=.061) lower in FRs compared to NFRs. More specifically, FRs showed worse scores in the domain of dynamic gait (p=.017) during; change in gait speed (p=.010), walking with pivot turns (p=.020) and the timed get up and go task (p=.048). Also, SLS duration was shorter in FRs for both disease-dominant and non-dominant legs (p=.046 & .019). Interestingly, AP-velocity of COP was decreased in FRs during SLS (p=.012 & .044) and during the foam-eyes-closed condition (p=.004), which implies less postural sway in FRs. Moreover, a similar trend for reduced sway parameters during the other double support conditions was apparent. In ML direction, no differences in postural sway were found between FRs and NFRs.

Conclusion: These results indicate that the Mini-BESTest and SLS-duration are potential clinical instruments to discriminate between FRs and NFRs’s postural capacity. Postural sway parameters revealed no clear relationship between postural instability and FOG. Though, the decreased AP-velocity of the COP could be interpreted as a reduced flexibility of FRs to respond to sudden changes in forward progression and explain why freezing may lead to falling. Whereas differences in postural sway between PD and HC are mostly found in ML direction, postural control impairments in the AP direction seem to be specific to FOG. However, tasks and outcome parameters should be refined to confirm this hypothesis.