## 15.10 Application of gait analysis in Parkinson's disease

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**Introduction:** Parkinson's disease (PD) is a chronic neurological condition that influenced gait pattern. This study evaluated with Gait Analysis (GA) kinematic and kinetic alterations in PD subjects, it characterized groups of different severity levels of pathology identified by UPDRS scale and it searched a correlation between GA indices and UPDRS scale.

**Methods:** 22 subjects with PD and 8 healthy subjects were evaluated by a 6-camera optoelectronic system with passive markers (VICON, Oxford Metrics Ltd., Oxford, UK), two force plates (Kistler, CH) and a Video system. Using UPDRS scale, all PD subjects were organized into three subgroups and classified with GA indices. Statistical analysis was performed by using parametric and non parametric tests ($p < 0.05$).

**Results:** GA identified the spatio-temporal, kinematic and kinetic abnormalities of PD walking, confirming and refreshing literature [1]. Pathological subjects were divided and characterized by quantitative indices in 3 subgroups: PD subjects without gait problems, with gait problems and with freezing. No correlations between GA and UPDRS scale were found.

**Discussion:** This study identified gait pattern in PD subjects integrating biomechanical and clinical information. It evaluated abnormal kinematic and kinetic pattern and characterized the subgroups with quantitative indices. This analysis is useful clinically in order to help the identification of more effective intervention of physiotherapy in PD subjects.

### References

[1] Morris MM. et al. Hum Mov Sci 1999; 18: 461–483.

## 15.11 Effects of subthalamic nucleus stimulation on kinematic and dynamic aspects of the initiation of gait in Parkinson's disease

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**Introduction:** The effects of subthalamic nucleus stimulation (STN-stim) on the ambulatory function of subjects with PD have been well described for steady-state walking, but they are unexplored for the transitional locomotor phases. The present study was aimed at investigating the impact of STN-stim on the gait initiation process, which involves activation of feed-forward postural control mechanisms.

**Methods:** Ten PD patients recipient of chronic STN-stim were assessed using biomechanical measures (kinematics and kinetics), during upright stance and during gait onset in response to a verbal cue indicating the leading (swing) leg side. All patients were tested under basal conditions and during bilateral stimulation.

**Results:** Effects of STN-stim on the standing posture included normalization of the vertical alignment of the trunk, thigh and shank segments, along with a backward shift of the centre of foot pressure (CoP). Improvements were more consistent in the case of standing preceding the gait initiation cue (attentional-demanding condition), as compared to simple quiet stance. Effects on the gait initiation included shortening of the imbalance and unloading phases, larger initial backward/lateral CoP displacement, more normal expression of the anticipatory postural action, increase in the first step length, height, and gait velocity.

**Conclusions:** Results indicate that STN-stim can produce i) improvement of the upright standing attitude, especially upon attentional-demanding conditions, and ii) restoration of the anticipatory postural actions associated with the initiation of a complex multijoint movement. These findings confirm the interaction of STN-stim with functionally basic motor control systems, but suggest a substantial impact on structures related to cognitive processing and/or motor memory.

## 15.12 Predicting falls in individuals with Parkinson's disease: a re-evaluation of current criterion values used with clinical measures of balance

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**Introduction:** Clinical balance tests are useful in assessing fall risk in elderly individuals. However, the utility of clinical balance tests as accurate screens for fall risk in persons with Parkinson's Disease (PPD) is unclear. For this reason, we sought to re-examine their criterion values with the goal of maximizing sensitivity.

**Methods:** Demographics, fall history, and baseline physical examinations were performed on 51 PPD, (mean[sd] = 69.94[11.28]). Each individual underwent balance testing with the functional reach test, the Berg balance scale, the dynamic gait index, timed up and go, and the cognitive timed up and go. Fallers and non-fallers were divided based on fall history and were compared on balance test performance. Receiver operator characteristic curves, sensitivity, specificity, and negative likelihood ratios were calculated for all balance tests.

**Results:** 55% of the participants had a history of falls. Using current criterion values, the sensitivity of all tests was low (<0.60) and the specificity was high (>0.85). Re-calculation of the criterion scores resulted in increased sensitivity for all tests (>0.75).

**Discussion and Conclusion:** Given the large financial, psychological and physical complications associated with a fall and minimal negative effects of fall prevention interventions, we propose different criterion values for PPD. The proposed criterion scores reflect the unique characteristics of postural control in PPD and their high risk for fall related injuries.

## 15.13 Improvements of sarcopenia and bradykinesia in persons with Parkinson's disease (PD) as a result of high intensity eccentric exercise

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**Introduction:** Age and disease related sarcopenia contribute to PD bradykinesia during gait and balance tasks. However, recent research suggests that sarcopenia can be reduced through eccentric exercise. To determine if this type of exercise would reduce bradykinesia, we studied the change of gait and balance outcomes as a result of 12 weeks of high intensity eccentric exercise.

**Methods:** Ten individuals with PD (mean age = 64.3; Hoehn and Yahr = 2.5) participated. Eccentric ergometry was performed 20 minutes/day, 3 days/week for 12 weeks. Participants were tested pre and post the 12 weeks with testing and training conducted 1–2 hours after medication intake. Isometric quadriceps strength, ten meter walk [TMW], six minute walk [6MW], timed up and go [TUG], and functional reach (FR]), were the outcomes. Data was analyzed using Wilcoxon tests ($p = 0.05$). To determine strength of effect, percent improvement and Cohen's effect sizes were calculated.

**Results:** Significant improvements (% change) were seen in strength (12%), gait (TMW 14%, 6MW 20%), and balance test performance (TUG 20%; FR 16%) ($p < 0.05$). Effect sizes ranged from 0.35 to 2.13.

**Discussion and Conclusions:** Persons with PD demonstrated improvements in bradykinesia (in gait and balance tasks) as a result of high intensity eccentric exercise. Eccentric exercise may help to minimize bradykinesia and maximize gait and balance function. This