INTRODUCTION

Parkinson’s disease (PD), a disease of the basal ganglia (BG), is characterized by progressive debilitation of the motor system. PD patients often suffer from postural instability and gait dysfunction. Treatment interventions targeted at improving gait and preventing falls among PD patients will benefit from novel recommendations to complement existing behavioral and pharmacological treatments. Emotion manipulations may hold promise for augmenting existing rehabilitation protocols. Naugle, Hass, Bowers, and Janelle [1] found that pleasant emotional states facilitate the anticipatory postural adjustments and the velocity of the first step during gait initiation in PD patients. They concluded that manipulation of emotional states may prove a beneficial strategy for optimizing gait initiation in PD patients. While emotional manipulations show promise as a viable therapeutic strategy, little is known regarding the role that affective stimuli might have on increasing variability in gait parameters (step length, stride length, and step velocity). Importantly, Roemmich et al. [2] found that PD patients exhibit more variability in gait compared to healthy cohorts. Such variability increases the likelihood of injurious and potentially catastrophic falls. Prior to implementing emotional manipulations in therapeutic strategies, it is important to identify how emotional states impact stepping variability. Our aim, therefore, was to determine how emotional manipulations affect gait variability in PD patients and age-matched controls.

We hypothesized that PD patients would exhibit greater variability in step length, stride length, and stride velocity, than the age-matched healthy controls. While no studies exist examining the role of emotion on gait variability, Coombes, Gamble, Cauraugh, and Janelle [3] found that emotional states do not impact the variability of sustained pinch force in healthy young adults. Considering these findings as well as those from Roemmich et al. [2] we hypothesized that emotional state would not impact gait variability in control participants, but speculated that emotional state might increase gait variability in PD participants.

METHODS

Following completion of informed consent, seventeen idiopathic PD patients (female = 3) and seventeen age-matched (±4 years) controls (female = 3) were fitted with retro-reflective markers on the lower body. Participants were positioned on a force platform (Bertec, Columbus, Ohio, model 4060) 6m in front of a 3.3 x 2m screen. During each trial, participants were presented with a fixation cross (2s) followed by a randomized picture stimulus (2-4s) at a resolution of 1024 x 768 pixels and a size of 127 x 91cm. Participants were instructed to begin walking and continue walking for several steps (approximately 4m) immediately following picture offset. Picture stimuli represented exemplars from the categories of attack, mutilation, contamination, erotica, happy people, and neutral objects and were selected from the International Affective Picture System (IAPS) [4]. Participants completed five trials per affective category. Kinematic data were sampled at 120Hz using a ten-camera Optical Motion Capture system (Vicon Peak, Oxford, U.K.).

RESULTS

Within subject variability of step length, stride length, and step velocity were calculated as the coefficient of variation ($\frac{\sigma}{\mu} \times 100\%$) [2]. A 2 (group: PD, control) x 6 (category: attack, mutilation, contamination, erotica, happy people, and neutral objects) ANOVA with repeated measures on the second factor was run for each of the five dependent measures (variability of step 1
length, step 2 length, stride length, step 1 velocity, and step 2 velocity). Analyses revealed significant differences in variability of the length of step 2 (p=0.020), stride length (p=0.012), velocity of step 1 (p=0.010), and velocity of step 2 (p=0.002) with greater variability in the PD group. Tests revealed no significant differences across valence categories and no significant group by valence interaction for any of the dependent measures.

**DISCUSSION & CONCLUSION**

Our hypothesis that PD patients would exhibit greater variability during gait than healthy controls was confirmed in all dependent measures except for variability of length of the first step. Additionally, our speculative hypothesis that emotional states would not influence variability in healthy controls was confirmed. However, emotional states did not increase gait variability in PD patients.

Combined, results provide additional support for the inclusion of emotional state manipulations in gait therapy within PD populations. Because gait variability did not increase as a function of manipulated emotional states, inclusion of emotional manipulations during gait therapy will likely enhance gait initiation performance [1] while not increasing the risk of gait instability or falls.

**REFERENCES**


*Figure 1: Mean variability percentages for dependent variables by group and valence category*