

TITLE: Muscle activation during gait in Parkinson's Disease compared to healthy controls, a preliminary analysis

AUTHORS: Diego Tosatto^{1,2}, Daniele Bonacina^{1,2}, Cristiano Alessandro¹, Cesare Maria Cornaggia^{1,2}, Daniele Piscitelli^{1,3}, Cecilia Perin^{1,2}

AFFILIATIONS:

¹ School of Medicine and Surgery, University of Milano Bicocca, Monza, Italy

² Istituti Clinici Zucchi - Gruppo San Donato, Carate Brianza (MB), Italy

³ Department of Kinesiology, University of Connecticut, Storrs, CT, USA

ABSTRACT

Background

Gait disorders are frequently reported in individuals with Parkinson's disease (PD). Despite extensive research, the specific gait features affected by PD are still not clearly defined.

Objective

To investigate muscle activation patterns during single and dual task gait in individuals with PD compared to healthy controls (HC).

Materials and methods

Participants with idiopathic PD and HC were analyzed and compared in two conditions: simple and dual task walking. Subjects were instructed to walk along a 10m straight path at comfortable speed, with the addition of a cognitive task (counting backwards) during the dual task condition. Data were collected by means of 3D Motion capture and surface electromyography to record muscle activity of both lower limbs of gluteus maximus, biceps femoris, rectus femoris, vastus medialis, gastrocnemius medialis, soleus and tibialis anterior. Qualisys Track Manager (QTM), Visual3D and Matlab, were used to analyze data. Comparisons were performed to study the effect of task (simple vs dual) and the effect of group (PD vs HC). After normalization of the EMG signals and the gait cycle, Statistical Parametric Mapping (SPM) was used to perform statistical analysis.

Results

12 PD (age 63.25 ± 6.09 ; H&Y 2 ± 0.62 ; disease duration 8.20 ± 7.80) and 6 matched HC (age 60.17 ± 9.39) were analyzed. The EMG envelope of PD showed a significant increase in the activation of gluteus maximus, biceps femoris and rectus femoris, during early to mid-stance, both in single and dual-task gait. A decreased activation of medial gastrocnemius and soleus muscles during the push-off phase was found, which however was not found to be significant.

Conclusion

We highlighted an increase in muscle activation in PD during early stance, associated with a reduced activity of the medial gastrocnemius and soleus during the push off phase.

Fig 1.

EMG activity of medial gastrocnemius (red) and tibialis anterior (black) during gait cycle in PD (top) and HC (bottom). Note the higher coactivation of the medial gastrocnemius in PD during the swing phase.

■ Gastrocnemius
■ Tibialis anterior

