The role of arm swing in gait: a combined EEG-EMG study in healthy participants and PD patients

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Ethical review	Approved WMO
Status	Recruitment stopped
Health condition type	Movement disorders (incl parkinsonism)
Study type	Observational non invasive

Summary

ID

NL-OMON46309

Source
ToetsingOnline

Brief title
Arm swing in PD gait

Condition

- Movement disorders (incl parkinsonism)

Synonym
Parkinson, Parkinson's disease

Research involving
Human

Sponsors and support

Primary sponsor: Universitair Medisch Centrum Groningen
Source(s) of monetary or material Support: Ministerie van OC&W

Intervention

Keyword: armswing, EEG-EMG, gait, Parkinson's disease

Outcome measures

Primary outcome

Measures of cortico-cortical, cortico-muscular and musculo-muscular coupling (derived from dynamic coherence analysis), compared between the different walking tasks and between PD patients and controls. In addition, measures of gait such as step duration, gait velocity and walking rhythm during the different tasks, compared between different walking tasks and between patients and controls.

Secondary outcome

NA

Study description

Background summary

In human gait, oscillating leg movement is accompanied by anti-phase arm swing, which has been suggested to serve stabilization, energetic efficiency and maintenance of the cyclic motor pattern. Although cerebral control of such four-limb movement pattern is embedded in both cortical and subcortical circuitry, the Supplementary motor area (SMA) seems to make a prominent cortical contribution. The altered four-limb pattern in Parkinsonian gait is characterized by small shuffling steps, stooped posture and reduced arm swing, while freezing may additionally occur. Reduced SMA activation has been associated with a wide range of impaired motor functions in Parkinson*s Disease (PD), including these gait characteristics. Cerebral circuitry controlling the onset and continuation of human locomotion and its pathophysiology remains to be further identified. Most neuroimaging techniques are inappropriate to measure brain signals during walking, making it difficult to study the underlying neural substrates responsible for gait disturbances in PD. With the wireless combined electroencephalography (EEG)- electromyography (EMG) technique we can measure brain and muscle activity while participants walk

under ecologically valid circumstances, hopefully leading to more understanding regarding the neural control of locomotion and to identification of potential targets for medical and surgical interventions.

Study objective

The primary objective is to examine the contribution of arm swing to the onset and continuation of locomotion in healthy individuals and PD patients and to study activity in its underlying functional brain networks. Secondary objectives are to evaluate how brain and muscles work together during the onset and continuation of walking and the differences in step duration, gait velocity and walking rhythm between PD patients and healthy controls.

Study design

Observational study
Wireless combined EEG-EMG will be used to measure brain and muscle activity during locomotion. During the experiments, participants will be fitted with a 32-channel EEG cap and EMG will be recorded from five of the major muscles involved in locomotion (tibialis anterior, soleus, rectus femoris, biceps femoris and gluteus medius). Moreover, accelerometers will be attached to the lower trunk and both left and right shanks. Each participant will then execute the following tasks:
(i) At random start-stop task (examining gait initiation), executed a) with and b) without armswing
* Participants walk back and forth through a hallway of 150m, while the researcher instructs the person to stop and start again thirty times at a (pseudo-) random time point.
(ii) Straight-path walking (examining continued gait)
* Participants walk back and forth through a hallway of 100m in a straight line a) with their arms in (normal) anti-phase with their lower limbs, b) with their arms in-phase with their lower limbs and c) without arm swing.
Other parameters of interest (medication use and comorbidities) will be collected from the patient*s file. Moreover, participants will be videoed during task execution to allow visual analysis of the walking pattern and identification of freezing of gait.
The study will consist of a pilot study and a case-control study. In the latter, differences between the various conditions in healthy subjects serve the primary objective, providing reference for comparison with the characteristically changed gait in PD patients. The pilot study is used to assess feasibility of the number of conditions to be tested in the patient group.

Study burden and risks

Patients will not be taken off any medication, but measurements will be planned

just before taking a new dose of the medication to ensure maximum occurrence of symptoms. There are no risks or benefits, and the burden is limited to the time invested in the test (approximately 2 hours, with breaks).

Contacts

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Trial sites

Listed location countries

Netherlands

Eligibility criteria

Age
Adults (18-64 years)
Elderly (65 years and older)

Inclusion criteria

Healthy individuals:
o Perceived healthy
o Able to walk independently (without support)
o Age * 18 years and < 80 years, age- and sex-matched with PD patients for case-control study
o Right-handed according to the Annett Handedness scale
o Written informed consent

All PD Patients:
o Able to walk independently (without support) (Hoehn & Yahr scale: Stage 2-3)
o PD diagnosis according to the UK Parkinson*s Disease Society Brain Bank criteria (A.J. Hughes, 1992)
o Trouble initiating gait (as reported in the medical file)
o Age < 80 (to limit the presence of vascular problems)
o Right-handed according to the Annett Handedness scale
o Written informed consent

Exclusion criteria

All participants
* Mini Mental State Examination (MMSE) score <26 (to exclude low task performance due to cognitive disabilities)
* (other) neurological or motor disorder (for patients: other than PD)
* Use of medication influencing movement (for patients: other than for PD)
PD patients
* Tremor-dominant PD

Study design

Design

Study type:	Observational non invasive
Intervention model:	Other
Allocation:	Non-randomized controlled trial
Masking:	Open (masking not used)
Control:	Active
Primary purpose:	Basic science

Recruitment

NL

Recruitment status:	Recruitment stopped
Start date (anticipated):	17-08-2018
Enrollment:	45
Type:	Actual

Ethics review

Approved WMO Date:	18-06-2018
Application type:	First submission
Review commission:	METC Universitair Medisch Centrum Groningen (Groningen)

Study registrations

Followed up by the following (possibly more current) registration

No registrations found.

Other (possibly less up-to-date) registrations in this register

No registrations found.

In other registers

Register	ID
CCMO	NL65958.042.18