Selective Control Assessment of the Lower Extremities to probe the increased metabolic cost of walking after Stroke

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Ethical review	Approved WMO
Status	Recruiting
Health condition type	Neuromuscular disorders
Study type	Observational non invasive

Summary

ID

NL-OMON53894

Source
ToetsingOnline

Brief title
SCALEStroke

Condition

- Neuromuscular disorders

Synonym
Stroke and CVA

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: Metabolic cost, Selective control, Stroke, Walking

Outcome measures

Primary outcome

Muscle co-activation measured by surface electromyography (Delsys 16-channel sEMG system, Natick, MA, USA) and energy cost measured by breath-to-breath analysis (K5, Cosmed, Rome, IT).

Secondary outcome

Kinematic description of the movements measured with a 10-camera motion capture system (Vicon Motion Systems Ltd, Yarnton, UK).

Study description

Background summary

Individuals post stroke show higher energy cost of walking compared to able-bodied individuals. Although several factors such as an increase in mechanical work, step length asymmetry and impaired balance control have been associated to contribute to this increased energy cost, the underlying mechanism remains unclear. The remaining impairments in motor control are related to functional deficits of walking and might explain a part of the increased energy cost of walking. These impairments manifest in an impaired ability to independently control individual muscles due to neural constraints, i.e. reduced selective control. Co-activation of the ankle plantar flexor muscles with knee- and hip-extensor muscles reflects this reduced selective control after stroke. Indeed, age-related adaptations in muscle co-activation patterns have shown to be related to the increased energy cost of walking in older adults. However, muscle co-activation could also serve as compensatory strategy to increase stability during walking post-stroke, due to task constraints of walking. To distinguish the neural constraints (reduced selective control) from task constraints (co-activation as a stability strategy in gait) after stroke, we will assess muscle co-activation during an isolated leg swinging task and compared this to muscle co-activation during walking. We hypothesise that there is a relationship between muscle co-activation during isolated leg swinging and walking, which explains the increased energy cost of

walking in people post-stroke, but not in healthy adults.

Study objective

The main objective is to examine the relationship between energy cost and (1) hip extensor and knee extensor co-activation, (2) plantar flexor and hip extensor co-activation and (3) plantar flexor and knee extensor co-activation in able-bodied individuals and individuals post stroke during an isolated swing movement of the leg.
The secondary objective is to examine the relationship between energy cost and (1) hip extensor and knee extensor co-activation, (2) plantar flexors and quadriceps co-activation and (3) plantar flexor and quadriceps co-activation during walking.
The third objective is to examine whether the co-activation during the isolated swing movement of the paretic leg explains increased energy cost during walking.
Both a younger (18-25 years) and older (50-75 years) able-bodied control group will be assessed, to be able to distinguish between-group differences due to age from between-group differences due to stroke.

Study design

This study is conducted as pilot study with a quasi-experimental study design. Participants will perform three walking tasks on a treadmill and three leg swinging tasks. Walking will be performed in three different speed conditions: 1) Comfortable walking speed (CWS), 2) Fixed walking speed (FWS; 0,6 m/s normalized to leg length) and 3) increased walking speed (IWS = CWS x 1.3). The three leg swinging tasks will be pace-matched to the leg-swinging frequency during each respective walking condition. For safety, participants will wear a safety harness attached to the ceiling to prevent them from falling during all tasks.

Study burden and risks

In total, 36 participants are tested on one occasion which will take about three hours. A very minimal risk of discomforts to participants is expected from participation in the study.

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

Individuals post stroke (n = 12)
- Diagnosis of stroke at least 6 months prior to testing.
- Age between 18 and 75 years old.
- Able to walk independently for a minimum of 6 minutes without an assistive device, manual assistance or walking aids.
- Paresis on one side of the body (hemiparesis).

Able-bodied young adults (n = 12)
- Age between 18 and 25 years old.

Able- bodied older adults (n = 12)
- Age between 50 and 75 years old.

Exclusion criteria

Individuals post stroke (n = 12)
- Unable to understand the study instructions in Dutch.
- Unable to execute the study instructions.
- Having received a botulinum toxin injection in the lower extremities within

12 weeks prior to testing.
- Indications of orthopaedic, neurological, cardiorespiratory and behavioral conditions other than stroke that may affect gait.

Healthy young and older adults (2 x n = 12)
- Unable to understand the study instructions in Dutch.
- Indications of orthopaedic, neurological, cardiorespiratory and behavioral conditions that may affect gait.

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:	Other

Recruitment

NL

Recruitment status:	Recruiting
Start date (anticipated):	04-04-2023
Enrollment:	36
Type:	Actual

Ethics review

Approved WMO

Date:	22-03-2023
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	NL83016.042.22