Age-related modulation of cortical and spinal excitability is associated with postural sway in standing*

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Primary Objective: To determine if spinal and cortical balance control mechanisms mediate the age-associated decline in balance skills. Secondary Objective: To determine the reliability of TMS and H-reflex measures in the soleus muscle in different...

Ethical review	Approved WMO
Status	Will not start
Health condition type	Muscle disorders
Study type	Interventional

Summary

ID

NL-OMON43098

Source
ToetsingOnline

Brief title
Neural control of balance

Condition

- Muscle disorders

Synonym
aging, elderly

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: aging, balance, H-reflex, transcranial magnetic stimulation (TMS)

Outcome measures

Primary outcome

The main study parameters are the size of the short-interval intracortical inhibition (SICI) and Hmax/Mmax ratio. SICI is the inhibition of the test motor evoked potential (MEP), when the suprathreshold TMS pulse (the test stimulus) is preceded by a few milliseconds with a subthreshold TMS pulse (the conditioning stimulus). SICI is a measure of motor cortical inhibition, and can thus be used to examine cortical influences. The Hmax/Mmax ratio, on the contrary, is a measure of the spinal influence.

Secondary outcome

The secondary study parameters are the Multiscale Entropy (MSE) complexity index of the CoP, and the modulation indices. The modulation indices are the percentage difference in SICI and Hmax/Mmax between normal and supported standing, and between the 5 standing conditions.

Study description

Background summary

Over 1/3 of individuals age 65 and older falls each year. A better understanding of neural, especially cortical and corticospinal, mechanisms of balance control would help to design more accurate balance assessments and treatments. With the combination of H-reflex and transcranial magnectic stimulataion (TMS) measures it is now possible to determine the role of cortical and spinal control of balance. We are interested in how age affects cortical and spinal control mechanisms of balance.

Study objective

Primary Objective: To determine if spinal and cortical balance control mechanisms mediate the age-associated decline in balance skills. Secondary Objective: To determine the reliability of TMS and H-reflex measures in the soleus muscle in different standing postures.

Study design

The primary objective will be investigated using a cross-sectional design, comparing young versus older adults. Reliability will be investigated with a test-retest design.

Intervention

During the experiment participants undergo TMS and peripheral nerve stimulation, while they are standing in 5 different postures:

Condition 1: Standing with a wide base stance (Stand WB): Standing with feet shoulder width apart.
Condition 2: Standing with a narrow base stance (Stand NB): Standing with medial foot borders touching.
Condition 3: Standing with a straddle stance (Stand Step): Non-dominant left foot on a solid wooden block in front of the body and the dominant right foot on the force plate.
Condition 4: Standing with a straddle stance (Stand Spring): Non-dominant left foot on a spring in front of the body and the dominant right foot on the force plate.
Condition 5: Standing on the right-dominant leg: (One leg stance): Standing on dominant foot with the non-dominant leg raised and flexed at the knee. The trial is stopped if the non-dominant left foot touches the floor.

Study burden and risks

Old adults will visit the Center for Human Movement Sciences one time. Young adults will visit the Center for Human Movement Sciences two times within a week. One testing session will last for maximal two and half hours. Subject will stand for a total of about one hours of the two and the half hours. Resting periods of 2-3 minutes are given as needed between trials and conditions. A longer resting period of 10 minutes is built in between the TMS and H-reflex data collection blocks.

Participation in this study includes electrical stimulation of the tibial nerve and magnetic stimulation of the motor cortex during standing. The TMS may cause slight discomfort lasting less than a second on the scalp near the coil. It may also cause some twitching of the muscles, the face and jaw, which may be

unpleasant and surprising but not painful. Peripheral nerve stimulation causes the muscles to twitch that can be more surprising than painful. It can cause some momentary burning and tingling sensation. There are no known long-term risks of peripheral nerve or magnetic brain stimulation. Subjects wear a harness that is attached to the ceiling to minimize any risk of falling. Electromyography (EMG) of the soleus and tibialis anterior muscles will be recorded. Therefore the skin underneath the three electrodes will be shaved and cleaned. This may cause some light irritation of the skin.

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

Young group: 18-40 years. Old group: over age 65

Exclusion criteria

1. Unable to stand independently for 10 minutes without rest
2. Epilepsy
3. Any metal in the brain/skull
4. Electrical, magnetic, or mechanical implantation: cardiac pacemakers or intracerebral vascular clip
5. Pregnancy or suspicion of pregnancy
6. History of seizures or unexplained loss of consciousness
7. Immediate family member with epilepsy
8. Use of seizure threshold lowering medicine
9. History of Schizophrenia
10. History of Hallucinations
11. History of other neurological disorders

Study design

Design

Study type:	Interventional
Intervention model:	Other
Allocation:	Non-randomized controlled trial
Masking:	Open (masking not used)
Control:	Active
Primary purpose:	Prevention

Recruitment

NL

Recruitment status:	Will not start
Enrollment:	30
Type:	Anticipated

Ethics review

Approved WMO

Date:	20-10-2016

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	NL57977.042.16