First dorsal interosseous muscle activation

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1) To determine the effect of the level of voluntary force on the magnitude of superimposed twitches evoked using peripheral nerve stimulation (PNS), motor point stimulation (MPS), and transcranial magnetic stimulation (TMS) in first dorsal...

Ethical review	Approved WMO
Status	Recruitment stopped
Health condition type	Other condition
Study type	Observational invasive

Summary

ID

NL-OMON44461

Source
ToetsingOnline

Brief title
FDI activation

Condition

- Other condition

Synonym
Healthy volunteers (fundamental research)

Health condition

Gezonde proefpersonen (fundamenteel onderzoek)

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: First dorsal interosseous, Superimposed twitch technique, TMS, Voluntary activation

Outcome measures

Primary outcome

Magnitude of the evoked superimposed twitches (expressed as percentage of the

response evoked at rest)

1) at different force levels

2) during a sustained maximal voluntary contraction

Secondary outcome

1) Activation of the first palmar interosseous muscle (antagonist of the first

dorsal interosseous)

2) magnitude of the evoked twitches (expressed as a percentage of the response

evoked at rest) after fatiguing the antagonist

Study description

Background summary

Voluntary muscle activation is a measure of central nervous system output that a muscle receives during a contraction. Muscle activation in an important measure to monitor muscle performance in healthy individuals, and in patient populations. During fatiguing muscle contractions, a reduction in muscle activation is indicative of deficits in central nervous system output to produce a maximal effort (Gandevia 2001).

One method to measure muscle activation is using the superimposed twitch

technique (Merton 1954). Electrical stimulation can be applied to a peripheral nerve (peripheral nerve stimulation, PNS) or directly to a muscle (motor point stimulation, MPS) during a voluntary muscle contraction. If the muscle fibers are not maximally activated by the central nervous system output, the electrical stimulus produces a force increment called a superimposed twitch. The magnitude of the evoked twitch corresponds to the level of voluntary muscle activation. A limitation of these methods is that it is only possible to determine whether a deficit in central nervous system output exists, but not whether this originates at the spinal or supraspinal level.

Another non-invasive method to measure voluntary muscle activation exists. This method uses transcranial magnetic stimulation (TMS) (Todd et al. 2003, Todd et al. 2016). In contrast to the methods described above where stimulation is applied in the periphery, TMS is applied to the motor cortex. This stimulation activates spinal motoneurons which are not maximally activated by the voluntary drive (i.e. supraspinal output). This provides useful additional information with regard to the mechanism underlying reduced muscle activation. This method has not been explored for the first dorsal interosseous muscle.

Study objective

1) To determine the effect of the level of voluntary force on the magnitude of superimposed twitches evoked using peripheral nerve stimulation (PNS), motor point stimulation (MPS), and transcranial magnetic stimulation (TMS) in first dorsal interosseous muscle.

2) To assess the change in the magnitude of twitches during a sustained maximal voluntary contraction of the first dorsal interosseous muscle, for twitches evoked using PNS, MPS, and TMS.

(Secondary Objective):
3) To assess the activation of the antagonist muscle (first palmar interosseous) during stimulation of the first dorsal interosseous at different TMS stimulation intensities (in a subgroup of participants).

4) 4. To assess the effect of fatiguing the antagonist muscle (first palmar interosseous) by eccentric exercise on the magnitude of superimposed twitches evoked using PNS, MPS, and TMS.

Study design

This is an intervention study during which participants perform multiple motor tasks with the right index finger (FDI muscle). Voluntary muscle activation is assessed by evoking superimposed twitches using electrical stimulation (MPS and PNS) and transcranial magnetic stimulation during the tasks.

Study burden and risks

There are no known risks of TMS or electrical stimulation. Electrical stimulation causes a brief, painful sensation. Insertion of the needle for the intramuscular EMG is painful while placing the electrodes. The time investment is 1.5 hours in total.

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

Age 18-65

Exclusion criteria

Migraine
Epilepsy
Pregnancy/suspected pregnancy
Metal implants in the head

Study design

Design

Study type: Observational invasive

Masking:	Open (masking not used)
Control:	Uncontrolled
Primary purpose:	Other

Recruitment

NL

Recruitment status:	Recruitment stopped
Start date (anticipated):	22-08-2018
Enrollment:	10
Type:	Actual

Ethics review

Approved WMO

Date:	10-07-2017
Application type:	First submission
Review commission:	METC Universitair Medisch Centrum Groningen (Groningen)

Approved WMO

Date:	25-09-2017
Application type:	Amendment
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	NL61803.042.17