

# First dorsal interosseous muscle activation

Published: 10-07-2017

Last updated: 12-04-2024

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...

<b>Ethical review</b>	Approved WMO
<b>Status</b>	Recruitment stopped
<b>Health condition type</b>	Other condition
<b>Study type</b>	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 is 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

### Public

Universitair Medisch Centrum Groningen

Antonius Deusinglaan 1  
Groningen 9713AV  
NL

### Scientific

Universitair Medisch Centrum Groningen

Antonius Deusinglaan 1  
Groningen 9713AV  
NL

## 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