Multi-unit microneurography and modeling of afferent responses of human muscle mechanorecpetors

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Ethical review	Not approved
Status	Will not start
Health condition type	Other condition
Study type	Observational invasive

Summary

ID

NL-OMON30370

Source
ToetsingOnline

Brief title
Multi-unit microneurography of human muscle afferents

Condition

- Other condition
- Neuromuscular disorders

Synonym
function of mechanoreceptors; function of muscle spindles and Golgi tendon organs

Health condition

fysiologie of diagnostiek van de functie van mechanoreceptoren in spieren

Research involving
Human

Sponsors and support

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

Intervention

Keyword: humans, mechanoreceptors, microneurography, muscle

Outcome measures

Primary outcome

The primary outcome of this study is the time required for finding a useful electrode position (evaluating two search methods), the measurement time until signal loss and a variety of indicators for the (relative) presence of the different fiber types in the signal, and furthermore the optimized settings of filters and other signal analysis techniques.

Secondary outcome

Secondary output parameters are diverse quantitative (model) descriptions of the mechanoreceptor functions, like the effect of amplitude and frequency of the movements. For completeness, we will also record any after effects of the microneurography as observed by the subjects.

Study description

Background summary

In the research into the physiology and pathophysiology of human muscle reflexes, it is attempted to discern the effects of motoneurones, muscles, mechanoreceptors and the central nervous system. For this purpose, the research group of Prof. van der Helm is using since a few years a mathematical physiological model of the neuromusculoskeletal system of the ankle, wrist, shoulder and other joints. These models are validated by applying force perturbations using robotic manipulators, and measuring muscle force, position

and EMG. Besides physiological research, these models and methods can also be used to acquire patient data. It is not possible with this method to discriminate between the effects of muscle mechanoreceptors (muscle spindles and Golgi Tendon organs) and the central nervous system. The muscle mechanoreceptors deliver signals that can only be directly measured using microneurography. These signals are the input of the central nervous system for reflex tasks.
Microneurography involves the insertion of a micro-electrode into a nerve fascicle, and delicate manipulation of this needle until the signal of a single mechanoreceptor is recognized. This 'single-unit' technique can give very detailed information, but it has major practical problems. It is hard to find a axon, statistics and luck determine the type of nerve fiber that is found, and even the smallest movements of the needle can cause signal loss, and one often has to be content with recordings of only 5 minutes. Furthermore, a single-unit recording gives only a very limited subset of the information that reaches the central nervous system, namely the combined signal of many receptors with different working ranges, sensitivity and dynamic response. All these problems are related to the minute active area of the micro-electrode.
Multi-unit microneurography, using a bigger active electrode area, might reduce these problems. This technique, which is usual for recording sympathetic nerve activity, measures the activity of multiple nerve fibers simultaneously. It is to be expected that this will relax the requirements on electrode position and stability, giving the opportunity of lengthier registrations, that will be less determined by luck, and more by statistics, en possible be more representative for the combined signal going to the central nervous system. Many applications of this technique are conceivable in physiological research and diagnostics of neurological patients, where the advantages are important and the absolute selectivity of the single-unit method is not required.

Study objective

The goal of this research is to determine whether multi-unit microneurography can be a practically useful technique for recording human muscle-afferent signals, and to determine which fiber types are present in the recorded signal to and from the central nervous system (type Ia and II afferents from muscle spindles, type Ib afferents from Golgi tendon organs and alpha motor efferents). While doing this, the technique will be further optimized.
A secondary goal is to compare the multi-fiber microneurograms with published single-unit results for various movements, velocities and forces.

Study design

Therefore, in an observational study setup, we will make multi-unit microneurograms during a variety of active and passive movements of the wrist joint.

Study burden and risks

The burden for the subject is small: a measurement session in a seating posture, with a maximum duration of 3 hours, with passive and active movements of the wrist joint, with limited amplitude and force. For the microneurography, a 0.2mm needle electrode will be inserted in the radial nerve. The chance of (mild) aftereffects is small (< 10%), and if any aftereffects occur, the usually dissolve within two weeks.

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 volunteers

using no medication
age 18 - 40 years

Exclusion criteria

microneurographic examination of nervus radialis of same arm in previous month
history of movement disorders in the arms

Study design

Design

Study type: Observational invasive

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

Recruitment

NL

Recruitment status:	Will not start
Enrollment:	12
Type:	Anticipated

Ethics review

Not approved

Date:	09-01-2007
Application type:	First submission
Review commission:	METC Universitair Medisch Centrum Utrecht (Utrecht)

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	NL15605.041.06