Coordination and proprioception of the knee joint - validity and reliability of the Mr Cube measurement system

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Objective of this study is to determine validity, test-retest reliability and discriminant ability of the Mr Cube system to assess coordination and proprioception of the knee joint in patients following ACL reconstruction, patients with patellar...

Ethical review	Approved WMO
Status	Recruitment stopped
Health condition type	Tendon, ligament and cartilage disorders
Study type	Observational non invasive

Summary

ID

NL-OMON39785

Source
ToetsingOnline

Brief title
Validity and reliability of the Mr Cube

Condition

- Tendon, ligament and cartilage disorders

Synonym
ACL reconstruction, knee osteoarthritis, patellar tendinopathy

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: coordination, knee injury, proprioception

Outcome measures

Primary outcome

The objective of the present study is to determine validity, test-retest

reliability and discriminant ability of the Mr Cube. The terms of study

parameters/endpoints are not applicable in this type of research.

Secondary outcome

Not applicable.

Study description

Background summary

Research has shown that injuries and disorders of the knee - such as rupture of the anterior cruciate ligament (ACL), patellar tendinopathy, and osteoarthritis (OA) of the knee joint - result in serious impairments of physical functioning. Next to the restoration and maintenance of biomechanical variables such as joint motion and muscle strength, enhancement of neuromotor control is considered an important component of the rehabilitation following injuries and disorders of the knee. Neuromotor control is commonly referred to as the ability to produce controlled movement through coordinated muscle activity, i.e. coordination. Neuromotor control results from a complex interaction between the somatosensory system and the musculoskeletal system. In a very basic model, the neuromotor control system consists of 3 components: sensory organs, neural pathways, and muscles.
Knee joint proprioception is essential to neuromotor control of the knee joint. At present, proprioception can be defined as the cumulative neural input to the central nervous system for specialised nerve endings called mechanoreceptors. Proprioceptive afferent information from mechanoreceptors in the muscles, ligaments, capsule, menisci, and skin contribute at the spinal level to arthrokinetic and muscular reflexes which play a large part in dynamic joint stability. It has been shown that a rupture of the ACL results in decrease in afferent proprioceptive signals from mechanoreceptors in the ACL. Impaired knee joint proprioception has also been established in patients with knee osteoarthritis and, although altered knee joint proprioception has not

been established yet in patients with patellar tendinopathy, there are strong indications that this is the case in these patients.
To date, there are a few measurement systems used to assess proprioception and coordination of the knee joint. Proprioception of the knee joint can, for instance, be measured by means of the Prosys system. However, the measurements with this system are relatively time-consuming and can only be made in a research setting. Moreover, proprioception is measured at the level of the impairment, not on a functional level. Numerous functional tests are available with which proprioception and coordination in a more functional setting that resembles daily activities or sporting activities can be assessed, for example a hop test or a jumping test. However, a combination of proprioception and coordination has to be used to perform these tests.
Recently, a commercially available training and rehabilitation tool, the Mr Cube, has gained popularity in the rehabilitation setting. With this system, neuromotor control, especially proprioception and coordination, can be functionally and dynamically trained. Moreover, the Mr Cube software contains an application with which the proprioception and coordination can be assessed. However, this assessment application has not been used yet as an outcome measurement tool for neuromotor control of the knee. However, before this system can be used as such, its validity, reliability and discriminant ability needs to be established. Therefore, the aim of this study is to investigate the validity, test-retest reliability and discriminant ability of the Mr Cube system to assess knee function in healthy persons, and in three patient groups: patients following ACL-reconstruction, patients with patellar tendinopathy, and patients with knee osteoarthritis.

Study objective

Objective of this study is to determine validity, test-retest reliability and discriminant ability of the Mr Cube system to assess coordination and proprioception of the knee joint in patients following ACL reconstruction, patients with patellar tendinopathy, in patients with knee osteoarthritis, and in healthy subjects.

Study design

Validity, test-retest reliability and discriminant ability of the Mr Cube system will be determined in healthy subjects and in three patient populations. In that sense, the study design is a cohort study with four cohorts.

To assess concurrent validity of the Mr Cube, participants of the study will perform several tests, next to the Mr Cube tests:
- Assessment of the threshold to detect passive motion (TDPM). With these measurements the proprioception of the knee joint will be assessed on the level of the impairment (i.e. an artificial anterior cruciate ligament, tendinopathy of the quadriceps tendon, osteoarthritis).

- Assessment of physical function skills by means of functional jump and hop tests (patients following ACL reconstruction and patients with patellar tendinopathy), or the timed-up-and-go test (patients with knee osteoarthritis). With these functional tests a combination of proprioception, coordination and muscle strength is measured.

- Subjective assessment of physical functioning by means of questionnaires. The scores of the questionnaires will be used to determine whether there is a relation between the score on the Mr Cube tests and the participant's opinion of his/her physical functioning.

To determine test-retest reliability, the participants will perform the Mr Cube tests for a second time, approximately one week following the first assessment.

Study burden and risks

Knowledge gained with this study can improve treatment and rehabilitation of ACL reconstruction, patellar tendinopathy and knee osteoarthritis. The risks involved with the measurements are negligible, since the measurements made in this study are comparable to physical exercises that are performed during physical therapy for rehabilitation of an ACL reconstruction, patellar tendinopathy or knee osteoarthritis.

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

Patients following ACL reconstruction:
- Age 18-50 years;
- ACL reconstruction was performed 8 weeks until 1 year previously.;Patients with patellar tendinopathy:
- Age 18-50 years;Patients with knee osteoarthritis:
- Age 50-75 years;
- Diagnosed with knee osteoarthritis, based on clinical signs and radiographs.;Healthy subject group:
- Age 18-75 years.

Exclusion criteria

Patients following ACL reconstruction
- Neurologic or neuromuscular disorder;
- Other lower extremity injury or disease that might interfere with the measurements;
- Unable to fill in the questionnaire in the Dutch language.;Patients with patellar tendinopathy
- Neurologic or neuromuscular disorder;
- Other lower extremity injury or disease that might interfere with the measurements;
- Unable to fill in the questionnaire in the Dutch language.;Patients with knee osteoarthritis
- Inflammatory polyarthritis;
- Total hip arthroplasty;
- Total knee arthroplasty at the other knee;
Neurologic or neuromuscular disorder;
- Other lower extremity injury or disease that might interfere with the measurements;
- Dementia;
- Unable to fill in the questionnaire in the Dutch language.;Healthy subject group
- Inflammatory polyarthritis;
- Hip and/or knee osteoarthritis;
- Total hip and/or total knee arthroplasty;
- Neurologic or neuromuscular disorder;
- Other lower extremity injury or disease that might interfere with the measurements;

- Dementia;
- Unable to fill in the questionnaire in the Dutch language.

Study design

Design

Study type: Observational non invasive

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

Recruitment

NL

Recruitment status:	Recruitment stopped
Start date (anticipated):	01-05-2013
Enrollment:	150
Type:	Actual

Ethics review

Approved WMO

Date:	10-04-2013
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	NL41769.042.12