Influence of vibration on cervicocephalic kinesthetic sensibility in patients with non-specific neck pain and healthy subjects

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The purpose of this study is to research the influence of vibration on the neck muscles on JPE and the effect of aging on this parameter in patients with a-specific neck pain. The second purpose is to research the influence of vibration on the neck...

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

Summary

ID

NL-OMON42715

Source
ToetsingOnline

Brief title
Influence of vibration on cervicocephalic kinesthetic sensibility

Condition

- Other condition

Synonym
neck pain, non-specific neck pain

Health condition

a-specifieke nekklachten

Research involving

Human

Sponsors and support

Primary sponsor: HagaZiekenhuis
Source(s) of monetary or material Support: HagaZiekenhuis

Intervention

Keyword: joint position error, neck pain, proprioception, vibration

Outcome measures

Primary outcome

Joint position error

Secondary outcome

Range of motion, coupled motion and JERK-index

Study description

Background summary

Several clinical signs are seen in research with neck pain patients, for example a reduced range of motion (ROM), jerky movement (JERK) and a reduced joint position sense (Sjölander et al., 2008). The jerky movement and reduced joint position sense are probably caused by sensorimotor disturbances (Sjölander et al., 2008). Sensorimotor disturbances play a role in the development, existence and return of several signs and symptoms in neck pain patients (Sterling et al., 2003; Treleaven et al., 2003; Heikkila and Astrom, 1996).

In particular, the contraction of the deep neck flexors is reduced in patients with chronic neck pain (Falla et al., 2004). Falla et al. (2011) showed that at a higher intensity of the pain occurs less contraction of the deep neck flexors. However, there is no correlation between the duration of pain and the degree of tensioning (Falla et al., 2011).
It has been showed that pain can bring a change on multiple levels of the nervous system. The influence of pain can have an impact on the sensitivity of muscle spindles and provide an altered cortical representation and modulation of cervical afferent input (Armstrong et al, 2008;. Treleaven 2008).

A change of cervical somatosensory activity can lead to disturbance in the sensorimotor function (Armstrong et al, 2008;. Treleaven 2008).

Critical to effective motor control is accurate sensory information (Riemann and Lephart 2002). The ability to sense position, known as proprioception, is essential in repositioning of the cervical spine (Kristjansson and Treleaven 2009; Armstrong et al., 2008). The proprioception is determined by a complex mechanism inside and outside the cervical spine. The vestibular system, muscular and arthrogenic receptors in combination with the central en peripheral nervous system play a key role in this process (Kristjansson and Treleaven 2009; Armstrong et al., 2008; Treleaven 2008). Multiple studies have demonstrated that the density of the muscle spindles, which are muscular receptors, in the cervical spine are highest in the suboccipital and mid cervical part of cervical muscles (Banks 2006; Boyd-Clark et al., 2002; Kulkarni et al., 2001; Amonoo-Kuofi 1983).
The smoothness of movement can be measured by the jerk index and the joint position sense (Lee et al., 2008; Pinsault et al., 2008; Sjölander et al., 2008; Lee et al., 2006). The joint position sense make use of the repostioningtest head-to-neutral or head-to-target and has the joint position error (JPE) as an outcome (Lee et al., 2008; Pinsault et al., 2008; Sjölander et al., 2008; Lee et al., 2006). The smoothness of movement and the joint position sense can be measured to get an impression of the proprioception of the cervical spine (Sjölander et al., 2008).
In earlier studies the joint position sense is measured in a two-(2-D) and three-dimensional(3-D) manner (Roren et al., 2009). Research by Cattrysse et al. (2009) showed that the reproducibility of a 3-D motion analysis is moderate to good (Cattrysse et al., 2009).
In a study in patients with a fusion of an anterior cervical segment measured in three-dimensional manner has been found that this three-dimensional method is a way to gain insight in the ROM and coupled movements, but also in the smoothness of movements (JERK) of the cervical spine (Cattrysse et al., 2012).

It is known pain has a bad influence on JPE in the cervical spine. Malmström et al., 2013 have investigated the effect of a unilateral pain stimulus in the cervical spine on the JPE. This shows that after the unilateral pain stimulus the JPE for the head-to-target repositioning is significantly greater on the side of the pain stimulus ($p < 0.001$). To the opposite side, no significant difference has been found.

Treleaven et al., 2011 examined the sensory disorders in four different groups. The four groups include: low traumatic cervical pain, traumatic upper cervical pain, nontraumatic low cervical pain and non-traumatic upper cervical pain. From this study it can be concluded that people with non-traumatic low cervical pain have less sensory disorders.

Two contradicting studies researched the effect of aging on the joint position error. In the study of Demaille - Wlodyka et al., 2007 neither age nor sex

influenced the ability to bring the head back to neutral. In the study of Vuillerme et al., 2008, 18 healthy young adults (average age 23 years) compared to 18 healthy adults older (average age 68 years) in the execution of the relocation cervicocephalic test. This study shows that older adults are less accurate and less consistent compared to younger adults.

Excercise, mobilisation and manipulation can improve the repositioning accuracy.
Vibration on the neck muscles in healthy subjects lead to a change in postural control to the opposite side.
Vibration has an opposite effect between neck patients and healthy subject. Neck patients show a decrease of the JPE and a reduced postural sway after vibration. Healthy subjects show an increased joint position error.

In conclusion. There is a tendency that vibration on the neck muscles in neck pain patiens leads to improvement of the JPE, however this is until now only been studied within the 2-D study of Beinert et al 2014.
There are no studies known in which the JPE, ROM, coupled movements and JERK 3-D have been measured after the administration of vibration on the neck muscles.

With vibration on the sub-occipital muscles is attempted to influence the proprioception. The expectation is that the effect of vibration in healthy subjects leads to a larger deviation in the JPE. The expectation in patients with non-specific neck pain is that vibration leads to an improvement in the JPE.
A positive effect of vibration on the JPE in non-specific neck pain patients shows that therapeutic goals and interventions should focus on proprioception.

Study objective

The purpose of this study is to research the influence of vibration on the neck muscles on JPE and the effect of aging on this parameter in patients with a-specific neck pain. The second purpose is to research the influence of vibration on the neck muscles on JPE in healthy subjects.

Study design

The study consists of a four phase procedure. In the first phase all patients will be aksed to make five movements according a standardized procedure within their maximum comfortable range of motion. The five movements are:
Axial rotation
Lateral bending
Flexion / Extension
Flexion/left rotation to Extension/right rotation = 3DL
Flexion/ right rotation to Extension/left rotation = 3DL

The procedure without vibration will be carried out twice; the first measurement can be seen as a warming-up and as a backup and the second measurement will be used as the actual registration for the study.
All movements start and end in the neutral position and every motion will be done three times in every direction (e.g. rotation left - rotation right - rotation left - rotation right - rotation left - rotation right).
After finishing all 5 movements the procedure will be carried out again.

In the second phase the joint position error shall be measured according to a standardized instruction. The subject is blindfolded and tries to remember the neutral position. Then the subject moves over the maximum comfortable range of motion and returns as accurately as possible back to the neutral position. The subject will be asked to return to the neutral position after the following three movements:
Axial rotation
Lateral bending
Flexion / Extension
All movements are carried out six times to both sides. In several studies is demonstrated that 6 trials are needed to derive stable estimates (Swait et al., 2007; de Vries et al., 2015).

In the third phase of the procedure the joint position error will be measured with vibration on the sub-occipital muscles. All movements in this procedure shall be carried out six times as well for the same reasons as described above.

In the fourth phase the movements of the first phase will be repeated with the application of vibration on the sub-occipital muscles. All movements start and end in the neutral position and every motion will be done three times in every direction. After finishing all 5 movements this procedure will be carried out again.

Intervention

Vibration on the sub-occipital muscles with a frequency of 100hz

Study burden and risks

In this study there is no risk of damage. All movements that are carried out (cervical flexion, extension, rotation and lateralflexion) are part of the normal movements in the daily life and are accepted in the diagnostic and therapeutic interventions. The use of electromagnetic trackers is non-invasive and extremely appropriate to analyse this motions. The application of vibration is already being used in several studies without harmful or side effects.

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

non-specific neck pain, 18-65 year old, understanding of the Dutch language

Exclusion criteria

surgery cervical or thoracic spine, pregnancy, neurological signs and symptoms in the upper extremity related to the neck, specific medical diseases affecting the cervical spine

Study design

Design

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

Recruitment

NL

Recruitment status:	Recruitment stopped
Start date (anticipated):	15-03-2016
Enrollment:	67
Type:	Actual

Ethics review

Approved WMO

Date:	23-10-2015
Application type:	First submission
Review commission:	METC Leiden-Den Haag-Delft (Leiden) metc-ldd@lumc.nl

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	NL53165.098.15