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Usefulness of manipulative therapy of the upper cervical joints in patients with cervicogenic headache - a single system experimental study

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Sammendrag

Prosjektets bakgrunn: Cervicogen hodepine anses som den tredje vanligeste hodepine-formen ifølge visse forfattere. Manuellterapeuter diagnostiserer og behandler disse pasientene. Cervical manipulasjonsterapi er en behandling som blir benyttet for å redusere hodepinen.
Hensikt og problemstillinger: Å undersøke effekten av manipulasjon av de øvre cervikale leddene vedrørende hodepine, nakkesmerte, cervikal bevegelighet og funksjon hos pasienter med cervicogen hodepine.
Materiale og metode: To kvinnelige pasienter 54 og 55 år som hadde vært plaget med hodepine i flere år ble behandlet 4 respektive 5 ganger. Symptomene ble reprodusert med palpasjon i øvre del av cervical columna. Cervical bevegelighet var redusert på symptomatisk side. Funnene ble målt med Numerical Rating Scale, Cervical Flexion-Rotation Test og Pasientspecifikk Funksjonsskala. Målingene ble gjennomført i baseline, under behandling og fire uker etter avsluttet behandling.
Resultater: Ingen forandring for hodepine og nakkesmerte forelå. Cervical Flexion-Rotation Test økte for begge pasientene og disse verdier var de samme ved fire ukers oppfølging. Ingen endring i skjema for pasientspesifikke funksjoner forelå foruten tretthet i nakken ved statisk sitting (pasient 1).
Konklusjon: Manipulasjon av C0, C1 og C2 hos to pasienter med cervicogen hodepine gav ingen endring av hodepine eller nakkesmerte men økt rotasjon i øvre cervicalcolumna. Forandringen av pasientspesifikke funksjonskår var liten.
Nøkkelord: Cervicogen Hodepine, Manipulasjonsterapi, Cervical Flexion-Rotation Test, Smerte, Cervikal Bevegelighet, Pasientspecifikk Funksjonsskala

Abstract

Summary of background data: Cervicogenic headache is considered as the third most common headache form by some researchers. Manual therapists diagnose and treat these patients. Cervical manipulative therapy is a treatment that is used to reduce the headache.
Purpose and problem statements: To investigate the effect of manipulation of the upper cervical joints regarding headache, neck pain, cervical range of motion and function in patients with cervicogenic headache.
Patients and Methods: Two female patients 54 and 55 years old with several years of headache were treated 4 respectively 5 times. The symptoms were reproduced with palpation over the upper cervical column. Cervical range of motion was restricted to the symptomatic side. The outcome measures were the Numerical Rating Scale, Cervical Flexion-Rotation Test and the Patient-Specific Functional Scale. The measurements were made in the baseline, during treatment and at four weeks follow up.
Results: There were no changes in headache and neck pain. Cervical Flexion-Rotation Test increased for both patients and the values remained at four weeks follow up. There were no clinically meaningful changes of patient-specific functions except for tiredness in the neck while sitting (patient 1).
Conclusion: Manipulation of C0, C1 and C2 in two patients with cervicogenic headache did not change the headache or neck pain but increased rotation in the upper cervical column. There was a small change on patient-specific functions.
Key words: Cervicogenic Headache, Manipulative Therapy, Cervical Flexion-Rotation Test, Pain, Cervical Range of Motion, Patient-Specific Functional Scale

1. Introduction and theory

Headache is a very common health problem. In a review study it was concluded that 46 % of the adult population worldwide has an active headache disorder. The prevalence for migraine was 11 %, for tension-type headache 42% and for chronic daily headache 3% (Stovner et al., 2007). All inhabitants (18 to 65 years old) in the Norwegian commune of Vågå were invited to participate in a study of headache epidemiology. 1838 persons of the communes total population of 3907 where included. The prevalence of cervicogenic headache (CGH) was 4.1%. Seventy five persons with CGH where found and of them 49% where female and 51% male with 27,8 years as the mean age of onset. It was concluded that CGH may be one of the three most common sorts of headaches (Sjaastad and Bakketeig, 2008). A randomly selected sample of 826 persons in a midsized Danish town was examined and 57 persons with headache were identified. Persons in the age of 20-59 years participated and a prevalence of 17,8 % of CGH where found (Nilsson, 1995).

Manual therapists need to know how to differentiate between different forms of headache so the patient can receive the most efficient treatment. Manipulative therapy is common in the manual therapy practice. It can be effective in the treatment of migraine but the effect on tension-type headache is unclear (Bronfort et al., 2010). This form of treatment is effective in the management of patients with cervicogenic headache (Nilsson et al., 1997,Jull et al., 2002).

1.1 Symptoms and diagnosis of CGH

Sjaastad et al have presented diagnostic criteria for CGH to a form of headache that is believed to be caused by the cervical spine. It is generally a unilateral headache but it can be bilateral. Sjaastad calls this unilaterality on two sides. The headache attacks vary from a few hours to a few weeks. In the beginning the pain fluctuates but the long term pattern is continuous pain. There are no particular radiological abnormalities associated with the diagnosis. The major criteria for the CGH diagnosis are:

I. Symptoms and signs of neck involvement.

a. The headache is reproduced by: neck movement and/or awkward head positioning and/or by external pressure over the upper cervical or occipital region on the symptomatic side.

b. restricted cervical range of motion (CROM)

c. nonradicular or radiucular ipsilateral neck, shoulder or arm pain.

II. Diagnostic anesthetic blockades in the cervical region eliminate the pain.

III. The head pain is unilateral without side shift.

The head pain starts in the neck and the intensity is moderate to severe. The characteristic of the pain is non-throbbing and non-lancinating[1]. Point II is obligatory in scientific work and point III is needed to be met to minimize the risk of including patients with tension-type headache (Sjaastad et al., 1998). In CGH neck mobility (flexion, extension and rotation) seems to be reduced compared to migraine, tension-type headache and controls (Zwart, 1997).

1.2 Differential diagnosis

Before making differential diagnosis between different headache forms serious pathology is excluded (see exclusion criteria in the method section below). Important headache diagnoses to differentiate between are: migraine without aura, tension-type headache, cluster headache, hemicrania continua and chronic paroxysmal hemicrania. *Migraine* without aura and CGH are both unilateral, more common in women and there is a possible occurrence of nausea and vomiting. In migraine without aura the headache can shift side but there is no side shift in CGH. Migraine often starts in the fronto-temporal region while CGH starts in the neck. Reproduction of pain by mechanical pressure in the upper cervical region on the symptomatic side, reduced CROM and occasionally nonradicular or radiucular ipsilateral neck, shoulder or arm pain is present in CGH but not in migraine and tension-type headache (van Suijlekom et al., 2010). During pregnancy CGH appears as before pregnancy but migraine symptoms usually disappear or improves during pregnancy (Sjaastad and Fredriksen, 2002). *Cluster headache* lasts from 20 minutes to three hours. The patient has often difficulties to stay still because of the pain and there are associated autonomic symptoms (for example ptosis (drooping eyelid), miosis (pupil contraction), rhinorrea (runny nose) and tearing). *Hemicrania continua and chronic paroxysmal hemicrania* are unilateral chronic headaches. The first can fluctuate in intensity and the last consists of attacks of short duration from 10 to 30 minutes. There is symptom reduction of indomethacin (van Suijlekom et al., 2010). In CGH there is marginal effect or a lack of effect of indomethacin (Sjaastad et al., 1998).

1.3 Anatomical basis for CGH

The anatomical basis for CGH is referred pain caused by convergence between trigeminal afferents and afferents from the upper three cervical nerves (C1-3). These nerves converge in the trigeminocervical nucleus in the dorsal horn of the spinal cord. Any structure innervated by these cervical nerves (for example synovial joints of C0, C1 and C2, muscles, C2 disc,

[1] lancinating pain = sudden, sharp pain associated with neurological disease (authors translation) (Lundh and Malmquist, 2001).

arteries and the dura mater) could be the source of CGH. In addition to the upper three cervical nerves and the trigeminal nerve the trigeminocervical nucleus receive afferents from the cranial nerves VII (facial nerve), IX (glossopharyngeal nerve) and X (vagus nerve). Afferents from the trigeminal nerve ramify in pars caudalis down to the level of the third cervical cord segment. The upper three cervical nerves ramify at the level they enter the spinal cord and send collateral branches to cranial and caudal segments. For example C2 sends branches to C1 and C3 and C3 sends afferents to C1 and C2. In summary the trigeminocervical nucleus is where nocieptive input from the head, throat and upper neck enter the central nervous system and it is a crucial nucleus for these afferents (Bogduk, 1995). Injection of sterile water over the great occipital nerve produced a pattern of referred pain in the distribution of the trigeminal nerve. This finding supports the evidence for convergence of cervical nerves in the trigeminocervical nucleus (Piovesan et al., 2001). In a trial the great occipital nerve and dura above the middle meningeal artery in rats were stimulated. Recordings of the neural activity in the C2 spinal dorsal horn during the stimulation were made. The neurons showed convergent input from subboccipital muscles and cutaneous receptive field innervated by the great occipital nerve and the dura. This supports the assumption of a functional continuum between the trigeminocervical nucleus and the upper cervical spine (Bartsch and Goadsby, 2002). Connections between the ligament nuchae and the cervical posterior spinal dura at the C0-C1 junction and between the rectus capitis posterior minor muscle and the posterior atlanto-occipital membrane have been confirmed. These findings may be a part of the etiology of CGH (Dean and Mitchell, 2002). Diagnostic blocks to the lateral atlanto-axial joints (C1) completely relieved the headache for 21 out of 34 CGH patients (Aprill et al., 2002). For patients with whiplash injury the zygapophysial joints in the cervical spine are the most significant source of pain. Injury to the intervertebral discs may also be a cause of the pain (Bogduk and Yoganandan, 2001). One hundred and ninety four patients with cervical zygapophysial joint pain made pain drawings of headache and neck pain. Diagnostic blocks to the zygapophysial joints where given and then the pain distribution of the different joints where determined. For the C1 and C2 joints the pain often where localized in the suboccipital region, on the vertex, in the front of the head and lower in the neck. Pain could also be referred to the orbit. Pain over the ear was referred from C1 but not from C2. Pain in the forehead referred from C2 was located lower than the pain from C1 (Cooper et al., 2007).

1.4 Manual examination of the cervical spine

The research on manual examination of cervical dysfunction have come to different conclusions on to which extent the manual examination can reveal a dysfunction or not. The inter examiner reliability for detecting upper cervical dysfunction was excellent to complete in one study. Six manipulative physiotherapists examined 10 patients with headache with or without neck pain. Each therapist examined all 10 patients. The results showed a complete agreement ($\kappa = 1$) between six pairs of the examiners and excellent between two pairs ($\kappa = 0.78$, $\kappa = 0.8$) (Jull et al., 1997). The opposite was concluded in another study. One hundred and seventy three patients with neck pain in which cervical zygapophyseal joint pain was suspected were examined. A high sensitivity of manual examination at the symptomatic cervical levels was present but there was low specificity (King et al., 2007). Palpation for cervical spine tenderness is a highly reliable examination tool. When the inter examiner reliability of palpation to the cervical spine was tested a 76.6% agreement between examiners was found (Hubka and Phelan, 1994). Palpation over the zygapophyseal joints in the cervical spine is the most appropriate screening test to identify dysfunctions of the neck compared to other common manual neck pain provoking tests (Sandmark and Nisell, 1995). End-feel improvement in the cervical spine after manipulative therapy was tested in a study. Motion palpation of end-feel improved in symptomatic subjects but not in asymptomatic subjects (Lakhani et al., 2009).

1.5 The cervical flexion-rotation test and CGH

Using the cervical flexion-rotation test (FRT) the examiner can identify dysfunction at the C1 level. In a recent study a sensitivity of 91% and a specificity of 90% ($P < .001$) for the FRT in patients with CGH were found (Ogince et al., 2007). The FRT is carried out by rotating the head to the left and right while the cervical spine is in full flexion. To limit the movement to the C1 segment, which is able to rotate in flexion, the cervical spine is held in full flexion (Hall et al., 2008). The test is significant when a firm resistance is met and range of motion (ROM) is less than expected (Ogince et al., 2007). In asymptomatic individuals the average rotation was 44° when the FRT was used. For patients with CGH the rotation was 28° to the symptomatic side. For patients with C1 as the most significant segmental level of CGH origin the rotation range was negatively correlated to severity of the headache (Hall and Robinson, 2004). In a later study on CGH patients a FRT of 25° was found (Hall et al., 2010b). To detect a change in ROM with the FRT after an intervention to the cervical spine a change of 7° must have taken place to be sure that it is due to the intervention and not measurement

error (Hall et al., 2010a). The reliability and diagnostic validity of the FRT in patients with CGH caused by a C1 dysfunction have been evaluated. In the same study the agreement between experienced and inexperienced examiners were evaluated. FRT mobility in patients with C1 dysfunction was reduced by 14° compared to asymptomatic subjects and reduced by 4° for CGH patients with another primary cervical segment level than C1. The possibility of having a smaller amount of involvement of C1 or maybe the FRT is not isolated to the C1 level were discussed. The results showed that the FRT is accurate and reliable in the diagnosis of CGH even for inexperienced examiners (Hall et al., 2008). In 85% of the time an experienced examiner can make a correct CGH diagnosis when the FRT is utilized (Hall et al., 2010b).

1.6 Mobilization treatment for CGH

Mobilization of the upper cervical spine is common in the treatment of CGH. Ten CGH patients were treated with mobilization of the upper cervical spine (C0-2 segments) for 9-12 times during 3-4 weeks. The results showed a reduction of frequency, duration and intensity of the headache (Schoensee et al., 1995). In another study CGH patients treated themselves with a technique called self-sustained natural apophysial glide (SNAG) for C1. The technique is described by Mulligan. The patients used a strap to mobilize the segment. FRT values increased by 15° compared with 5° in a placebo group. There were a considerable reduction of headache severity in the SNAG group compared to a placebo group at 4 weeks and 12 months follow up (Hall et al., 2007).

1.7 Spinal manipulative therapy

Spinal manipulation is a treatment for spinal pain where a high-velocity low-amplitude thrust is applied to a synovial joint. In relation to the manipulation there is often an audible ”crack” and this sound is often seen as the confirmation of a successful manipulation. The reason for this sound is an event in the synovial fluid called cavitation. Cavitation is the formation and activity of bubbles (cavities) in the synovial fluid when the pressure in the joint is reduced (Evans, 2002). Manipulation have been defined as “1) A force is applied to the recipient; 2) The line of action of this force is perpendicular to the articular surface of the affected joint; 3) The applied force creates motion at a joint; 4) This joint motion includes articular surface separation; 5) Cavitation occurs within the affected joint”. The sound that occurs during cavitation cannot be reproduced until 90 minutes after the manipulation (in the lumbar spine) (Evans and Lucas, 2010).

The long-term effects of medication (celecoxib, vioxx and paracetamol), acupuncture (8-10 needles locally in the paraspinal musculature and 5 needles in distal points) and manipulative therapy (at the spinal level of involvement) in patients with chronic spinal syndromes were compared in a randomized clinical trial. One hundred and fifteen patients with mechanical spinal pain syndromes were included. At one year follow-up only the group that received manipulative therapy showed significant long term benefit (Muller and Giles, 2005).

1.8 Manipulative therapy for CGH and neck pain

In a case report the orthopaedic manual physiotherapy intervention to a 40 year old woman with CGH was described. The patient received a combination treatment of thrust and non-thrust manipulations, soft tissue mobilization, postural re-education and exercise. After treatment the patient had clinically meaningful improvements regarding headache, pain and disability (van Duijn et al., 2007). In a randomized controlled trial with 200 CGH patients the effect of manipulative therapy, exercise and a combination of these two therapies where studied. The manipulative therapy treatment consisted of both low-velocity joint mobilization and high-velocity manipulations based on the Maitland system. The training was a low load endurance exercise for the longus capitis and colli and the deep neck flexor muscles, which are stabilizers in the cervical spine. Twelve months after the treatment the patients still had significantly reduced frequency and intensity of headache and neck pain. The manipulative therapy and exercise groups had the same effect and the combination did not produce a better result than the therapies alone (Jull et al., 2002). In another study the lasting effects on CROM after manipulative therapy to the cervical spine twice a week over a three week period were tested. Thirty-nine CGH patients were randomized into two groups. Manipulative therapy was compared to a combination of low-level laser and deep friction massage. One week after the intervention both treatment groups had an increased CROM but it was not statistically significant. The authors concluded that the effect of manipulative therapy did not have lasting changes on CROM (Nilsson et al., 1996). The effect of manipulative therapy in patients with CGH was tested in a randomized controlled trial with a blinded observer. The manipulative therapy group was again compared to a group that received low-level laser and deep friction massage. Analgesic use, headache duration and intensity were significantly reduced in the manipulation group after five weeks. Manipulative therapy was more effective than the soft-tissue therapy (Nilsson et al., 1997). In a study twenty six CGH patients were treated with manipulation of the upper cervical segments. The intervention lasted for two weeks and the patients reported a decrease in headache severity, duration and frequency. Even though the

results were significant the authors could not come to any clear conclusions because of the lack of a control group (Whittingham et al., 1994).

In an early randomized controlled trial the effect on CROM after cervical manipulation was tested. Twenty six patients with neck pain and reduced mobility in one or more cervical zygapophysial joints received manipulative therapy for three weeks. The treatment resulted in significant instantly reduced neck pain. There was a significant increase of cervical rotation and this effect lasted for three weeks after treatment (Howe et al., 1983). In an uncontrolled pilot study the effect on pain and CROM of a single manipulation in fifty patients with unilateral neck pain were evaluated. Pain was measured with a numerical rating scale (NRS) and CROM with a goniometer. There was a correlation between an increased cervical rotation and decreased neck pain (Cassidy et al., 1992). A randomized controlled trial was carried out on seventy patients with neck pain. The immediate effects of a single cervical manipulation were compared to a control mobilization technique. The neck pain and CROM were assessed directly after and five minutes after treatment. There was a greater improvement in the manipulation group than for the control mobilization group. Similar to Cassidys results increase of CROM (in all directions) were associated with decreased neck pain (Martinez-Segura et al., 2006). Thirty patients with neck pain and restricted CROM underwent manipulative therapy in a pilot randomized clinical trial. The results showed significant improvements in reduction of pain, disability and an increased CROM (Wood et al., 2001).

2. Purpose and Problem statements

2.1 Purpose

The purpose of this study was to investigate if there were changes in headache, neck pain, FRT and patient-specific functions after manipulation of the C0, C1 or C2 zygapophysial joints in patients with CGH. Manipulative therapy is a central theme in the teaching of manual therapy at the University of Bergen and the treatment is often used by manual therapists.

2.2 Problem statements

Will intensity of headache and neck pain decrease and is there an increased CROM measured with FRT after manipulative therapy of upper cervical segments in patients with CGH? Will patient-specific functions be less difficult to perform after the therapy?

3. Method

3.1 Study design

In this study the method to assess the chosen treatment was a single-system experimental design (SSED). A SSED uses extended baselines and this gives an opportunity to see the natural fluctuation of the variables in the study. This design was customized for two participants who will be described accurately below. The generalizability of the results is finite to similar cases. The clinician has to decide if the current patient resembles the patient described in the study to know if the results are useful or not (Domholdt, 2005).

3.2 Selection of participants

To find suitable patients for the study a so called purposive sampling was used. There was no randomization. Patients seeking manual therapy treatment for headache and neck pain at a clinic specialized in manual therapy in Norway were asked to participate in a study. They were informed about the purpose of the study (Appendix 1).

Inclusion criteria:

- Criteria I (symptoms and signs of neck involvement) and III (the head pain is unilateral without side shift) from Sjaastads definition of CGH. See 1.1 for more details. These two criteria were chosen due to it is part of a regular manual therapy examination procedure. Criteria II (diagnostic anesthetic blockades in the cervical region to eliminate the pain) is seen as a gold standard in diagnosing CGH (Bovim et al., 1992) but it is not included in this study because of the lack of resources to perform the procedure.
- A positive FRT. A range of rotation less than 32° is considered a positive test (Ogince et al., 2007).
- Patients of both sexes between the ages of 18 and 55 years.

Exclusion criteria are so called red flags of serious pathology presented in the examination and contraindications for manipulative therapy. The red flags are:

- Severe headache of sudden onset associated with neck stiffness, photophobia, nausea and vomiting (acute subarachnoid hemorrhage)
- Sub acute headache that is progressively worsening, a change in the headache and abnormal neurological signs (tumour)
- Severe headache associated with fever (infection) or skin rash

- Headache with a history of cancer, HIV or other systemic illness.
- Headache associated with neurological signs other than typical visual or sensory aura or changes in consciousness (intracranial lesion, stroke or acute subarachnoid hemorrhage)
- Worsening of symptoms with cough, exertion or Valsalva
- Temporal headache with onset after 50 years of age with a throbbing quality and palpation tenderness of the temple (giant cell arteritis)
- History of trauma to the ligaments in the upper cervical spine
- Positive deKleyn or premanipulative tests for vertebral artery insufficiency
- New onset of headache during pregnancy or post-partum

If any of these conditions were met then the patient would have been referred to medical examination (Boyling, 2004,Bigal and Lipton, 2007).

Patients with contraindications for manipulative therapy were excluded from the study. Contraindications described by Roar Robinson (lecturer at the manual therapy master program at the University in Bergen in Norway) are:

- Pain in all directions, pathological end feel as hyper mobility or severe movement restriction with a hard and non-elastic stop
- Muscle spasm, torticollis (soft blockage)
- Increasing symptoms
- Root symptoms
- Vascular abnormalities (aortic aneurysm) or anticoagulant therapy
- Moderate to severe osteoporosis or long term corticosteroid use
- Fracture, cancer or severe flu.

3.3 Variables

This SSED was quasi-experimental and it included controlled manipulation of one independent variable. It was made prospectively due to that it was planned and deliberate. In this study the independent variable was manipulation of the three upper zygapophysial joints in the cervical spine. There were two levels of the independent variable, the baseline (when there was no treatment applied) and the intervention phase. Each participant was her own control due to the sampling of several measurements in the base line and in the intervention phase. Two SSED´s were conducted simultaneously. The dependent variables consisted of

intensity of headache and neck pain, range of rotation in the upper cervical joints measured with the FRT and the patient-specific functional scale (PSFS).

3.4 Data collection and outcome measures

The baseline consisted of two measures of headache, neck pain and FRT (one after the examination and one before the first treatment). Daily during the seven days long baseline the patients estimated intensity of headache and neck pain on the numerical rating scale (NRS). This scale is easy for patients to use and it is sensitive for clinical changes during a set of treatments. The patient rated the pain on a scale from 1 to 10 where 1 = no pain and 10 = worst possible pain. A treatment has clinically meaningful effect if the change is minus 2 points on the scale. The NRS can be used for intensity or duration of pain (Salaffi et al., 2004). The scores were written down on a "pain-diary" the patient received on the first visit for examination (Appendix 2). During the intervention phase the manipulation of the upper cervical joints was performed by a manual therapy student (the author) and the measures were made by another manual therapy student who acted as an independent assessor. The patients were scheduled to receive six treatments (two per week during three weeks) during the intervention phase. It was not possible to accomplish all six treatments because the patients had plans for their summer vacation. Patient 1 received 4 treatments and patient 2 received 5 treatments (Table I and II). Before each treatment measures of headache and neck pain intensity on the NRS and mobility with the FRT were performed. The measures were also repeated four weeks after completed treatment to assess the long-term effects of the treatment.

A CROM device or myrinometer was used during the FRT. It was fixed to the patient´s head with straps in the transverse and coronal planes with a "compass" goniometer attached to the centre of the head. Cervical rotation in maximal flexion was then measured (the FRT). The CROM device has acceptable inter and intra tester reliability (Capuano-Pucci et al., 1991). The inter tester reliability of the CROM device in patients with cervical dysfunction has been examined. Flexion, extension, lateral flexion and rotation where measured in 22 subjects in a sitting position. The correlation coefficients between the testers were .76 to .98. It was concluded that the device was reliable (Rheault et al., 1992). The criterion validity of the CROM device in healthy adults was excellent when the device was compared with the optoelectronic system, OPTOTRAK. The CROM device was suggested as an outcome measure in patients with neck pain (Tousignant et al., 2006). A change between 5° to 10° is required to be sure that a change in spinal ROM has occurred (Fletcher and Bandy, 2008). In

a recent study the reliability of FRT measures over time was tested. Fifteen patients with CGH were tested four times during a two week period. The FRT measures were stable during this time interval (Hall et al., 2010a).

The PSFS was used to achieve the functional status of the patient (Appendix 3). In this study it was filled out at the examination, then again after the completion of the intervention phase and finally at the four weeks follow up. In this scale the patient report functions that is problematic to accomplish and rates the difficulty on a scale from 1-10. The validity, reliability and sensitivity of change of the scale have been tested and all three aspects were found to be excellent. This scale is equal to the neck disability index in detecting change over time (Westaway et al., 1998). In this study the PSFS was used to capture the individual problems the patients may have, caused by the headache. The reason for not using the PSFS on every occasion when the patients received treatment was because it would be too time consuming for the patients. The patients should feel that it was comfortable to participate in the study.

3.5 Procedure

Each patient was examined by a student of manual therapy (the author) before the intervention phase. There was an interview and a clinical examination of the cervical spine following the standard examination procedure taught at the manual therapy master program at the University in Bergen. The procedure for the examination was structured as following: inspection, active tests of function, passive tests of function, isometric contraction of muscles, muscle length tests, neurological tests, special provocation tests, palpation and segmental mobility tests. The examination ended up with a conclusion that was communicated to the patient. Tests for ligaments, bony and capsular structures in the upper cervical spine and tests for the vertebral artery were performed. Tests used for stability of the upper cervical spine were: ligamentum transversum test, stability test for side-dislocation of C1 and ligamentum alare test (Solberg, 2002). Test for the vertebral artery were deKleyns test (full rotation and extension of the cervical spine held for 30 seconds) and the C1 premanipulative hold. The later test was shown to create more stress to the contra lateral vertebral artery than deKleyns test (Arnold et al., 2004). Manual therapists are recommended to focus on the patient history and careful physical examination to exclude vertebral artery dissection (VAD). Neck pain can be the only symptom in VAD. If VAD is suspected then provocation tests should not be performed and the patient should be referred to a neurologist. Provocative testing is also not

very probable to screen patients for post-manipulative injury to the vertebral artery because of the low sensitivity of the tests (Thiel and Rix, 2005).

In the intervention phase the manipulation treatment was given to the joints with an end-feel suitable for manipulative therapy. This varied some from one treatment to another (Table I and II). Indication for manipulative therapy is described as a restricted end-feel within the joint and that the restriction is palpable. After the manipulation there is an immediate restoration of motion which is palpable within the joint (Lakhani et al., 2009). C0 and C1 were manipulated with a traction technique. The segments caudal to C1 are held in a non-coupled position for protection of these segments while C0 and C1 are manipulated separately in a coupled position. C2 was manipulated with a rotation technique with cranial segments in a neutral position and caudal segments in a non-coupled position. These techniques are taught at the manual therapy master program at the University in Bergen in Norway (Ellingsen, 2007).

3.6 Statistical analysis

To determine if there had been any changes between experimental conditions visual analysis of level and trend were used. By using level and trend analysis description of certain patterns in the data across time can be discovered. When several data points are present it is possible to predict future data points with some precision. In visual analysis of single subject data the scientist visually inspect the data to see if there have been any effects of the independent variable in the experiment. There are two questions to ask: Have any change taken place in the data patterns? Are they related to the experimental conditions? The relative value of the data pattern on the dependent variable is called level. The way the data pattern is increasing or decreasing over time is called trend. If the data patterns changes direction when for example a independent variable is introduced a change in trend has happened. If the baseline data is variable then interpretation of the experimental effects will be questionable. Then there will not be possible to make strong conclusions based on the values (Wolery and Harris, 1982). In this study the visual presentation of the results were made in the Microsoft Office Excel 2007 software.

The agreement between visual analysis and statistical tests of single subject data has been examined. Forty two hypothetical graphs were constructed and then 32 rehabilitation and health care providers visually inspected the graphs and determined if there were significant

treatment effects present. The study showed an agreement of 86% between visual analysis and statistical significance. Both techniques were sensitive to medium and large treatment effects in the studied graphs (Bobrovitz and Ottenbacher, 1998).

3.7 Ethical considerations

According to the Helsinki declaration there are certain demands on the scientific method. It is important to put the participants health and integrity before considerations about research and society. In Norway the Regional komité for medisinsk og helsefaglig forskningsetikk (REK) is reviewing all research projects in biomedicine where there are trials on humans and when the trial is not a part of an ordinary established treatment procedure (Dalland, 2007). The treatment in this project is a part of an ordinary treatment procedure so there will be no need to seek approval at the REK. The patients were informed of the possible side effects and risks with the treatment and they gave their informed consent before participating in the study. Informed consent means that the participants are given adequate information to decide if to participate in the study or not. The participant gives permission for participating in tests and treatment by signing a document. The participants were also informed that they were anonymous in the study and that it was voluntary to participate. They could end their participation in the study any time they wanted (Appendix 1). The norwegian law, personopplysningsloven, states that the individual should be protected from violation of the personal integrity when handling personal information (Dalland, 2007). In this project all personal information were de-identified and replaced with a number.

3.8 The patients

Twenty five patients were examined and two patients met the inclusion criteria for CGH and had a positive FRT to the symptomatic side.

3.8.1 Patient 1

Interview: Patient 1 was a 54 year old woman. She reported having fluctuating headache and neck problems over the last 15 years. She had no history of trauma to the head or neck. Around the eastern holiday this year she cycled 7 km and the headache increased after that activity. The headache was not increased or provoked by coughing, sneezing or physical activity like stair climbing. She had no balance problems while walking. There were no signs of vertebral artery insufficiency. She did not report any problems with her general health.

The pain was located on the left side of the upper cervical spine. The headache usually lasted for periods of three days. If it was intense it had a tendency to spread to the right side of the neck. The character of the pain was a constant "squeezing". She rated it to seven on the NRS. Left rotation of the neck and stress could trigger the pain. Resting in a dark room could ease the pain. It was often more intense in the morning but it could occasionally increase in the end of a working day. She had a pacemaker and used beta blocking and rhythm decreasing medication and had normal blood pressure. She was diagnosed with migraine and used imigran medication but it usually only partly relieved the migraine symptoms. She had tested manipulative therapy and massage of the neck for shorter periods (two to three treatments) with a temporary decrease of headache and neck pain. Earlier in life she had been active with cross country skiing but now she was not regularly physically active. She worked full time as a librarian. If the pain increased during a working day she could leave work earlier that day.

Inspection: The head was slightly rotated to the right and the left shoulder was elevated.
Active tests of function: Flexion, extension, protraction and retraction were normal. Side flexion to the left was painful, restricted and it was not relieved by passive elevation of the right shoulder. Left rotation was also restricted. Right side flexion and rotation was normal. Shoulders, jaw joints and thoracic spine were pain free with normal ROM.
Passive tests of function: Left side flexion and rotation were painful, restricted and with a firmer end-feel compared to the right side.
Isometric contraction of muscles: Flexion, extension, side flexion and rotation of the neck did not reproduce any symptoms.
Muscle length tests: The scalenus and trapezius muscles were shorter on the left side of the neck but did not reproduce any symptoms while tested.
Neurological tests: Reflexes, sensibility of the skin, identification muscles and neurodynamical tests were normal.
Special provocation tests: Vertical traction and compression did not reproduce any symptoms. Spurlings maneuver to the left reproduced a local pain on the left side of the upper cervical spine. Ligamentum transversum test, stability test for side-dislocation of C1 and ligamentum alare test were normal. deKleyns test and the C1 premanipulative hold did not reproduce any symptoms.
Palpation: Palpation over the left C1 and C2 zygapophysial joints and musculature close to the joints reproduced the headache. The left scalenus and trapezius muscles were in higher tension than on the right side.

Segmental mobility tests C0 to Th3: The C0 segment had normal mobility. The left C1 joint had restricted end-feel to the left. The FRT was positive to the left with reproduction of headache at 20°. The test was normal to the right (40°). The C2 joints were bilaterally restricted. The rest of the cervical spine had normal mobility.

Main findings: The FRT to the left (20°) was positive. Palpation over the left C1 and C2 joints reproduced the headache and neck pain. Restricted segments were the left C1 and C2 joints.

Manipulative therapy: After the baseline patient 1 did not have any headache or neck pain. The hypo mobility in the neck remained. Although she wanted to try the treatment to see if it could increase cervical range of motion and have preventative effect on the headache.

Patient 1 was treated with manipulation to the upper cervical at four times during two weeks. The planned six treatments were reduced to four because patient 1 went on vacation the third week. The treated segments are presented in Table I.

Table I: Treated segments - Patient 1

Treatment nr:	Segments
1	C2 bilaterally
2	C0 on the left side and C2 bilaterally
3	C1 on the left side and C2 bilaterally
4	C1 on the left side and C2 bilaterally

3.8.2 Patient 2

Interview: Patient 2 was a 55 year old woman with a history of headache lasting for the last ten years. She had no previous trauma to the head or neck. The headache was increasing for different lengths of time, mostly a couple of days, for approximately two times every year. Coughing, sneezing or physical activity like stair climbing did not provoke the headache. She reported no balance problems. She has had good effect on the symptoms from manipulative therapy three years earlier but the treatment was only occasional. She had not tried a series of treatments. She also used specific stretching techniques to the upper cervical segments for self-treatment. There were no signs of vertebral artery insufficiency. Once or twice a year she had nausea with associated vomiting. Migraine-like headache always preceded these symptoms. High intakes of sugary food or wine could trigger these symptoms. She had good effect from migraine medication on these occasions.

The pain was located on the right side of the upper cervical spine and the lower part of the right side of the occiput. The character of the pain was stiffness and she estimated it to vary from one to four on the NRS with more pain in the mornings. Protraction of the head and static positions of the head and neck over prolonged periods provoked the pain. Stretching, movements of the neck and coffee intake reduced the symptoms. She had an MRT verified lateral recess stenosis on the right side of the C5 segment. She had no other diseases and did not take any other medications. She reported her general health to be good. She worked as a manual therapist and was physically active with cycling and gymnastics for recreation.

Inspection: Normal posture and normal curvatures of the spine.
Active tests of function: Flexion, extension, protraction and retraction were normal. Side flexion to the right was restricted. Passive elevation left shoulder with an intent to loosen muscles of the left side of the cervical spine produced some increased right side flexion but some of the restriction remained. Right rotation was also restricted. Left side flexion and rotation were normal. Shoulders, jaw joints and thoracic spine were pain free with normal ROM.
Passive tests of function: Right side flexion and rotation were restricted with a firm end feel.
Isometric contraction of muscles: Flexion, extension, side flexion and rotation of the neck did not reproduce any symptoms.
Muscle length tests: The right levator scapulae muscle was shorter but did not reproduce any symptoms when it was tested.
Neurological tests: Reflexes, sensibility of the skin, identification muscles and neurodynamical tests were normal.
Special provocation tests: Vertical traction, compression or Spurlings maneuver did not reproduce any symptoms. Ligamentum transversum test, stability test for side-dislocation of C1 and ligamentum alare test were normal. deKleyns test and the C1 premanipulative hold did not reproduce any symptoms.
Palpation: Palpation over the right C2 zygapophyseal joint and musculature close to the joint reproduced the headache. The right levator scapulae muscle had higher tension than the left.
Segmental mobility tests C0 to T3: Traction joint play and coupled right sidebending to the right CO joint with rotation to the left had restricted end-feel. The right C1 joint had restricted end-feel to the right. The FRT was positive to the right with reproduction of headache at 20°. The test was normal to the left (40°). The C2 and C3 joints were bilaterally restricted and there was a restriction in the right C5 joint. The rest of the cervical spine had normal mobility.

Main findings: Palpation over the right C2 joint and a positive FRT to the right (20°) reproduced the headache and neck pain. Restricted segments were the right C0, C1 and C5. The C2 and C3 joints were bilaterally restricted.

Manipulative therapy: Patient 2 presented the same intensity of headache and neck pain when tested after the baseline. During the baseline she reported lower intensity of headache and neck pain then during testing. Patient 2 was treated with manipulation to the upper cervical for five times during three weeks. The planned six treatments were also reduced with this patient because of her summer vacation. The treated segments are presented in Table II.

Table II: Treated segments - Patient 2

Treatment nr:	Segments
1	C2 on the right side
2	C2 bilaterally
3	C0 on the right side
4	C0 and C2 on the right side
5	C0 on the right side

4. Results

4.1 Patient 1

4.1.1 Headache, neck pain and FRT – Descriptive statistics and visual analysis

During the baseline both the headache and neck pain decreased from 7 to 0 on the NRS. This level was steady during the intervention phase. At four weeks follow up the headache intensity was 0 but the neck pain had increased to 5 on the NRS (Figure 1 and 2).

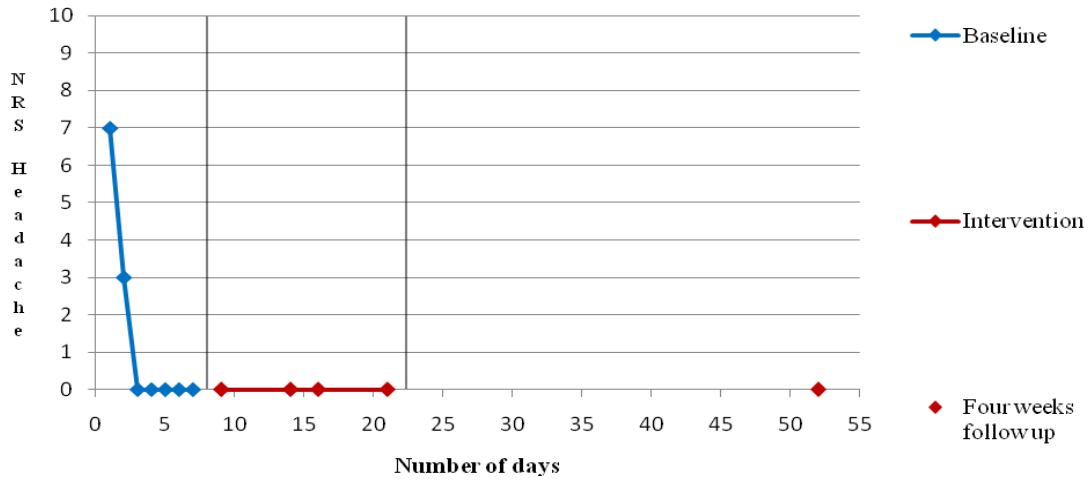

Figure 1: Headache intensity measured with the NRS - Patient 1

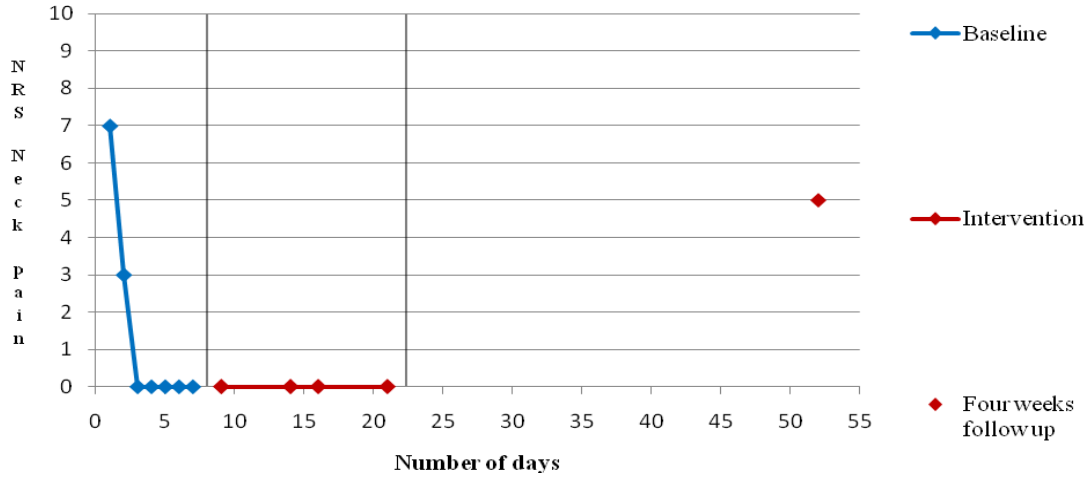

Figure 2: Neck pain intensity measured with the NRS - Patient 1

The FRT was 40° to the right (asymptomatic side) during the baseline, intervention phase and follow up. FRT to the left was 25° and 20° during the baseline. In the intervention phase there was a change in both trend and level with a follow up value of 30° rotation to the left (Figure 3). The trend had consequently a change in direction towards an increased FRT value during the intervention phase and at follow up.

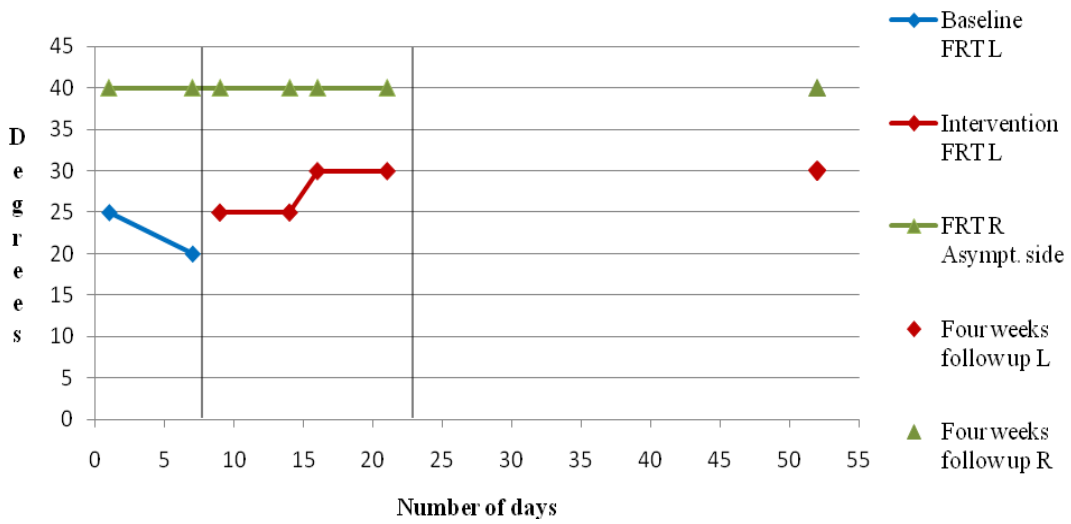

Figure 3: FRT measured in degrees - Patient 1

4.1.2 The patient-specific functional scale

Patient 1 reported two activities that were difficult to carry out (Table III). The activities she reported were neck rotation to both sides and a feeling of being tired in the neck while she was sitting for longer periods of time. The experienced neck rotation did not change during the study but the feeling of being tired in the neck while sitting decreased from 4 to 2 on the difficulty NRS.

Table III: The patient-specific functional scale

Activity	Difficulty day 1	Difficulty day 21	Difficulty day 52
Neck rotation, both directions	5	5	5
Tired in the neck while sitting	4	4	2

4.2 Patient 2

4.2.1 Headache, neck pain and FRT – Descriptive statistics and visual analysis

The headache and neck pain fluctuated during the baseline and there were no apparent trends. In the start and at the end of the baseline the values were 4 on the NRS. During the intervention there were trends for lower values for both headache and neck pain. At four weeks follow up the headache intensity had decreased to 0 and the neck pain to 1 on the NRS (Figure 4 and 5).

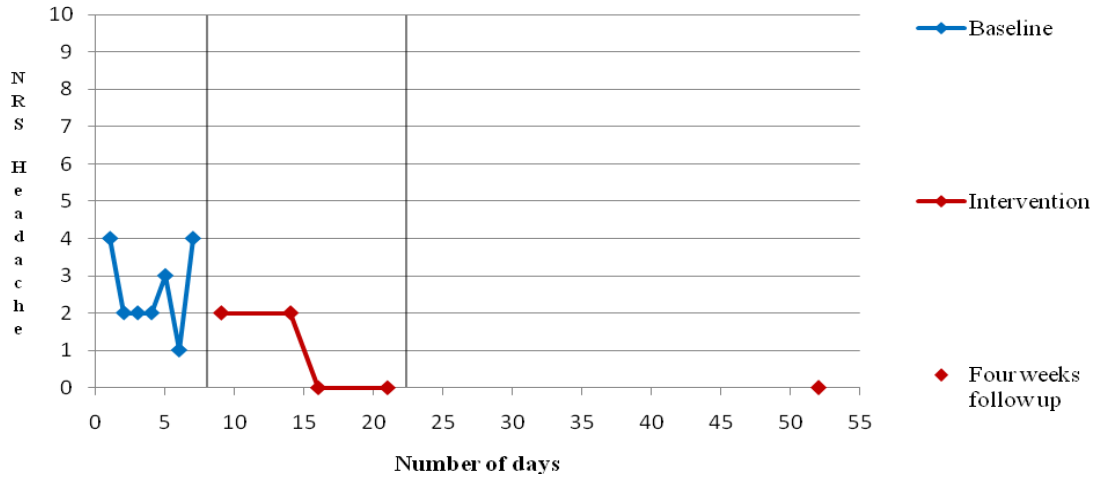

Figure 4: Headache intensity measured with the NRS - Patient 2

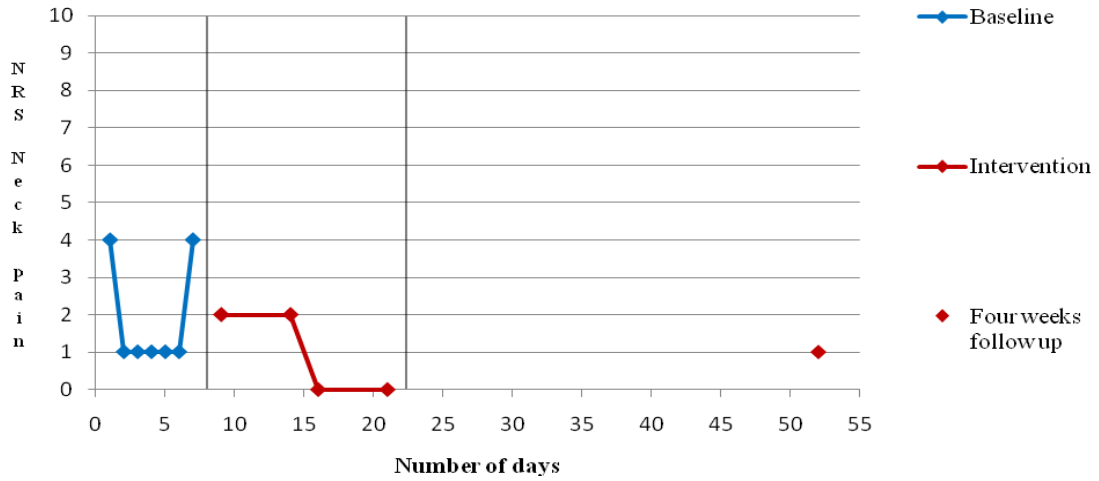

Figure 5: Neck pain intensity measured with the NRS - Patient 2

The FRT for patient 2 was 40° to the left (asymptomatic side) during the baseline, intervention phase and follow up. FRT to the right was 20° on both measurements during the baseline. In the intervention phase there was a change in level and at follow up the score was 30° rotation to the left (Figure 6). Two measures where excluded beacuse patient experienced irritation in the neck caused by the right C5 lateral recess stenosis. The patient wanted to have the measure taken only on the follow up and this wish was respected.

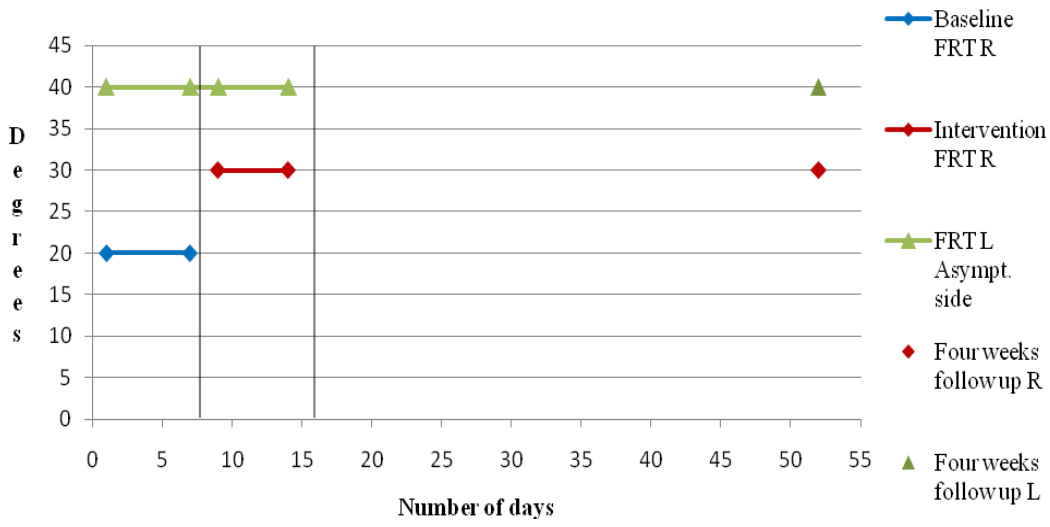

Figure 6: FRT measured in degrees - Patient 2

4.2.2 The patient-specific functional scale

Patient 2 reported four activities that were difficult to accomplish (Table IV). She reported activities where the neck was held in a static position while bicycle riding and sitting, working with hands over the head and a feeling of finite mobility in the neck in the mornings because of stiffness. Only the activity prolonged sitting had a decrease in difficulty level at the follow up. Morning stiffness decreased during the study but then went back to the original value at follow up.

Table IV: The patient-specific functional scale

Activity	Difficulty day 1	Difficulty day 21	Difficulty day 52
Prolonged bicycle riding	2	2	2
Prolonged sitting	2	1	1
Working with hands over the head	3	3	3
Morning stiffness	2	1	2

5. Discussion

In this SSED two patients with symptoms of CGH were treated with manipulative therapy of the upper cervical joints. The experiment was designed to evaluate the usefulness of manipulative therapy and how this treatment could affect the intensity of headache and neck pain, FRT values and the function in patients with CGH. Two female patients (54 respectively 55 years old) participated in the study. They both have had problems with headache and neck pain for several years. The patients presented neck symptoms that provoked the headache. The FRT was positive with a firm resistance met earlier than expected compared to the asymptomatic side (Ogince et al., 2007). FRT mobility was 20° to the symptomatic side for both of the patients. This indicates C1 as the primary cervical segment level causing the headache but as described earlier the FRT may not be isolated to the C1 segment (Hall et al., 2008). The patients had clear involvement of the C2 segment on the symptomatic side when tested with palpation over the joint and end feel testing. Patient 2 had also restrictions on the C0, C3 and C5 segments. The patients were treated with manipulations at 4 respectively 5 treatment visits.

The results indicated no change in headache or neck pain intensity during the intervention phase for patient 1. At the first visit she reported 7 on the NRS on both headache and neck pain intensity but during the baseline the intensity decreased to 0 and was stable during the intervention phase. At four weeks follow up the headache still was 0 but the neck pain had increased to 5. One explanation for the decreased pain intensity during the baseline could be a careful first examination. This may have mobilized the symptomatic segments with a pain reducing effect. Another explanation could be that a natural reduction of symptoms occurred during the baseline. The pain intensities during the intervention phase may have been stable regardless if there was treatment or not. The treatment maybe had effect on headache and neck pain. The values at follow up were NRS 0 for the headache and NRS 5 for the neck pain. Reduction in headache and neck pain intensity after manipulative therapy corresponds with results in previous studies (Cassidy et al., 1992,Whittingham et al., 1994,Nilsson et al., 1997,Jull et al., 2002,Martinez-Segura et al., 2006,van Duijn et al., 2007). The change for neck pain was 2 points on the NRS and that is concerned as a clinically meaningful change (Salaffi et al., 2004). However it is very uncertain that the treatment was the important factor that changed headache and neck pain because of the lack of change in both level and trend during the intervention phase. Because of the lack of change during the intervention no

conclusions of the treatment effect were made. The FRT values for patient 1 changed in both level and trend during the intervention phase and this change remained in the follow up four weeks later. This is probably a change caused by the manipulation. If the mean value during the baseline is calculated then it was 22,5° (25°+20°/2) and 27,5° (25+25+30+30/4) for the intervention phase (Ottenbacher, 1986). The change in mean level was 5°. As concluded in another study a change of 5°-10° is required to be sure that an intervention has changed the CROM (Fletcher and Bandy, 2008). Though it was not 7° as required in change for FRT value (Hall et al., 2010a). This finding corresponds with the results of earlier pilot studies on lasting changes on CROM (Howe et al., 1983,Cassidy et al., 1992). It is though more likely that manipulation does not have lasting changes on CROM. When tested in a randomized, blind and controlled trial there were no lasting changes on CROM after manipulative therapy (Nilsson et al., 1996).

An interesting part of the treatment is the change or effect the patient experiences from the treatment. To capture the patient's own experience of the treatment the PSFS was used. Patient 1 reported that neck rotation to both sides and a feeling of being tired in the neck while she was sitting for longer of periods of time as two difficult activities. She did not experience any change in neck rotation even though the FRT value had increased. A possible explanation for this may be that there is a difference between active and passive CROM. There were no restrictions on the musculature on the right side of the neck that could resist the movement but maybe she could not activate the cervical musculature properly to make use of the increased mobility and reach the end range. When tested with the FRT end range may have been reached because of the outer forces applied by the tester. The other activity, a tired feeling in the neck while sitting for longer periods of time, did change from 4 to 2 on the difficulty NRS. This can be considered as a clinically meaningful effect (Salaffi et al., 2004). Maybe the change in mobility in the zygapophysial joints made it possible for the musculature in the neck to work more dynamic than before the treatment. This may have increased blood circulation in the area and decreased the feeling of being tired in the neck.

Patient 2 reported a headache and neck pain intensity of 4 on the NRS when tested on the first visit and 4 when tested before the first treatment. During the baseline she reported lower values on the NRS in the pain diary (Figure 4 and 5). These lower values may be caused by a tendency for the patient not to go the outer positions in cervical rotation to avoid provoking of headache and neck pain. During the intervention phase the level decreased for both types of

pain and there was a trend towards lower scores. At one month follow up the headache intensity was 0 on NRS and neck pain was on 1. The treatment probably influenced both the headache and neck pain to decrease. Even though there were reductions of headache and neck pain it is very uncertain to conclude that it was the intervention that caused the change. The baseline data were not stable and then interpretation of the experimental effects will be questionable (Wolery and Harris, 1982). Consequently no strong conclusions based on the values were made. The FRT value for patient 2 increased in level during the intervention phase and at follow up the same value (30°) was reached. This increased mobility was probably caused by the manipulation. The increase was 10° and this exceeds the requirement of 7° discussed earlier (Hall et al., 2010a). The activities patient 2 reported on the PSFS did not change on difficulty NRS except for prolonged sitting that decreased one point on the NRS but this is not considered as clinically meaningful (Salaffi et al., 2004).

An important question to ask is whether the right diagnosis was made. Patient 1 had a pain located on the left side of the upper cervical spine. The headache lasted for periods of three days. It had a tendency to spread to the right side of the neck and had a character of a constant "squeezing". Left rotation of the neck provoked the headache. These symptoms fit with the criteria of CGH (Sjaastad et al., 1998). Patient 2 had a pain that was located on the right side of the upper cervical spine and the lower part of the right side of the occiput. Protraction of the head and static positions of the head and neck over prolonged periods provoked the pain. Her symptoms also fits the criteria for CGH (criteria I a). For patient 1 stress could trigger the pain and resting in a dark room could ease the pain. She was diagnosed with migraine and used imigran medication. Migraine without aura and CGH has been studied and support for coexistence of the diagnoses has been found. The diagnoses have common symptoms for example the unilaterality (Sjaastad et al., 1999). This seems to be the case with patient 1. The migraine might have been a confounding factor influencing the experiment. Patient 2 occasionally had migraine-like symptoms that were alleviated with migraine medication so in her case migraine could also be a confounding factor.

The combination of the criteria for CGH and the FRT could be at a useful tool for manual therapists in the diagnosis of CGH. Criteria II (diagnostic anesthetic blockades in the cervical region to eliminate the pain) cannot be performed by manual therapists but maybe the combination of criteria I (neck symptoms), III (unilaterality) and the FRT are enough for the everyday manual therapy practice? The diagnostic accuracy of the FRT when differentiating

between migraine without aura, multiple headache forms and CGH was examined in a study. A significant reduction in FRT in patients with CGH but not in the other two diagnoses was found. With a FRT less than 30° it was possible to differentiate between the diagnoses (Hall et al., 2010b). In this study the combination of the CGH criteria and the FRT strengthens the construct validity of the study as it is likely correct diagnosis where made. However as discussed earlier it is also likely that there were a coexistence of migraine and CGH.

When treating patients with cervical manipulation there is a risk of side effects such as headache, stiffness, local discomfort, radiating discomfort and fatigue (Cagnie et al., 2004) There is also a minimal risk of serious injury for example cerebrovascular incident and death. Although, it has been calculated to be 100 to 400 times more likely to be hospitalized or to die from using NSAID medication than from spinal manipulation (Dabbs and Lauretti, 1995). Physical therapists who use manipulative therapy has been involved in less than 2% of the cases of serious injury and no deaths has been attributed by physical therapists using manipulative therapy. When there has been injury after manipulation thrust techniques using rotation of C1 is overrepresented (Di Fabio, 1999). In Norwegian manual therapy manipulation of the C0 and C1 joint is performed with a traction technique. This technique is intended to put little stress on the vertebral artery and is considered to be a safe way of manipulating these joints.

How adequate were the outcome measures in the study? NRS for headache and neck pain, FRT for upper cervical rotation and the PSFS were used in this study. The values on NRS during the baseline are questionable. As discussed earlier the patients may avoid the pain provoking positions and then when they were tested in the clinic higher values were achieved. This difference in values may have produced baselines with values from two different situations. One in the outer positions of CROM (with FRT) and another in a more neutral and less pain provoking position of the cervical spine. It is then questionable how much the pain diary contributed to the baseline measures. Although the pain diary gave a more nuanced picture of the patients problem than the measures in the clinic alone. The FRT values can be considered an appropriate measure. The FRT is shown to be accurate and reliable in the diagnosis of CGH. This was also the case even if the examiner had a shorter time of clinical experience (Hall et al., 2008). The examiner in this study who was a student of manual therapy had a shorter time of clinical experience of manual therapy practice but that probably did not influence the results much. Maybe the PSFS was best in capturing the patients' actual

problem. The reasons why the patient seeks treatment are because some bodily function is finite and in the PSFS the patient are free to express functions difficult to carry out.

Manipulative therapy is a passive treatment and in this study it was the only treatment used. The positive aspect of using only one treatment form is that it makes it easier to evaluate the treatment effect of that specific treatment. In this way the internal validity of the study strengthens. The drawback is that it is passive and the patient is fully dependent on the manual therapist. It would be favorable for the patient if the manipulations were combined with some form of specific exercise they could manage on their own. An effective home treatment of CGH is the self-sustained natural apophyseal glide for C1. As described in the introduction of this report the exercise is a self-treatment where the patient uses a strap to mobilize the cervical spine (Hall et al., 2007). Manipulative therapy in combination with this home exercise may be more effective than the separate treatments. It would also have pedagogical benefits for the patient when she can control and reduce the pain on her own. The combination of these two treatment forms can be the subject of future research. In the daily manual therapy practice different forms of exercise, muscle stretching and correction of posture are often combined with manipulative therapy. This expanded approach may have been more useful in the treatment of the patients in this study, in particular in the treatment of patient 2. She did not have any clinically meaningful changes on the PSFS and maybe a combination of different treatments and exercises would have been more effective.

6. Conclusion

The results from this SSED indicate that manipulative therapy of the upper cervical joints in patients with CGH may be useful to increase the upper cervical rotation. This finding corresponds with earlier studies as discussed above. There were no conclusions made regarding changes of headache and neck pain because of a lack of shift in trend (patient 1) and variable baselines (patient 2). One of the patients had a decreased feeling of being tired in the neck at follow up but the other values on the PSFS did not give any clinically meaningful changes. The patients in this study may have had more changes in their symptoms with a combination of manual therapy and exercise than manipulation alone. I recommend that future studies of treatment of CGH may be done by combining manipulative therapy and specific self-mobilization of the upper cervical joints.

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Appendix 1

Forespørsel om deltakelse i forskningsprosjektet

"Effekt av manipulasjonsbehandling av øvre cervikalledd hos pasienter med cervicogen hodepine"

Bakgrunn og hensikt

Dette er et spørsmål til deg om å delta i en forskningsstudie for å vurdere effekten av manipulasjonsbehandling av nakken vid cervicogen hodepine. Hensikten med studien er å se om hodepine og nakkesmerte minsker og om beveglighet øker etter manipulasjonsbehandling av den øvre delen av nakken. Studien vil inngå i mastergradsoppgave ved mastergradsutdanningen i Manuellterapi ved Universitetet i Bergen.

Hva innebærer studien?

Studien består av et intevju og klinisk undersøkelse før behandlingen begynner. Behandlingen pågår to ganger per uke i tre uker. Ved hver behandling vil du bli undersøkt. Du vil før og etter behandlingsserien bli bedt om å besvare et spørreskjema. Manipulasjonsbehandling er smertelindrende og beveglighetsøkende. En rask impuls mot ledden i nakken gies og oftest høres en lyd i sambånd med impulsen. Bivirkninger som økt hodepina, stivhet i nakken og ubehag kan førekomme, men disse symptomer forsvinner vanligtvis innen et døgn etter behandlingen. Behandlingen er ofte benyttet av manuellterapeuter. Vi ønsker å undersøke effekten av behandlingen ved cervicogen hodepine.

Hva skjer med informasjonen om deg?

Informasjonen som registreres om deg blir liggende i din pasientjournal. Alle opplysningene vil bli behandlet uten navn og fødselsnummer eller andre direkte gjenkjennende opplysninger. Det vil ikke være mulig å identifisere deg i resultatene av studien når disse publiseres.

Frivillig deltakelse

Det er frivillig å delta i studien. Du kan når som helst og uten å oppgi noen grunn trekke ditt samtykke til å delta i studien. Dette vil ikke få konsekvenser for din videre behandling. Dersom du ønsker å delta, undertegner du samtykkeerklæringen. Om du nå sier ja til å delta, kan du senere trekke tilbake ditt samtykke uten at det påvirker din øvrige behandling. Dersom du senere ønsker å trekke deg eller har spørsmål til studien, kan du kontakte Roar Jensen eller Johan Bäcker.

Ansvarlig for studien er:

Roar Jensen	
Førsteamanuensis og Manuellterapeut	Student, Klinisk master i Manuellterapi
Institutt for Samfunnsmedisinske fag	Institutt for Samfunnsmedisinske fag
Universitetet i Bergen	Universitetet i Bergen
Telefon: 55 58 67 31	Telefon:

Samtykke til deltakelse i studien

Jeg har fått muntlig og skriftlig informasjon om studien og er på dette grunnlaget villig til å delta i studien

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(Signert av prosjektdeltaker, dato)

Appendix 2

Headache and neck pain diary

Hodepine og nakkesmerte
Vennligst angi det tallet på skalaen som svarer till hvor mye hodepine og nakkesmerte Du har per dag.

0 1 2 3 4 5 6 7 8 9 10

0 = Ingen smerte 10 = Så vondt som det går an å ha

Dag	Hodepine	Nakkesmerte
1		
2		
3		
4		
5		
6		
7		

Appendix 3

PASIENTSPESIFIKK FUNKSJONSSKALA (PFS)

Patientspecific Functional Scale etter Stratford P et al. Physiother Canada 1995;47:258-63, Chatman AB et al. Phys Ther 1997;77: 820-9, Westaway M et al. JOSPT 1998;27:331-8. Oversatt av Margreth Grotle, NRRK, Diakonhjemmet sykehus, 2006.

LES OPP OG FYLL UT ETTER ANAMNESEN OG FØR EVT. UNDERSØKELSE.

Ved første møte (Les tekst i kursiv)

– Jeg vil be deg beskrive fem (**eller tre**) viktige aktiviteter som du har problemer med å utføre eller ikke kan utføre i det hele tatt på grunn av dine _____ plager. Hvilke fem (tre) aktiviteter har du vansker med å utføre?

Beskriv de aktivitetene pasienten nevner og fyll i tabellen under.

Visa skalaen "Grad av vanskelighet" til pasienten:
– Angi det tallet på skalaen som svarer til hvor vanskelig du synes det er å utføre denne aktiviteten.
Be pasienten peke på det tallet som gjelder aktuelle aktivitet og noter dette i tabellen.

PASIENTSPESIFIKK FUNKSJONSSKALA

Beskriv skalaen fra 0 til 10 med Grad av vanskelighet for pasienten - angi endepunktene der 0 er ingen vansker og 10 er max vansker. *– Angi det sifferet på skalaen som svarer til hvor vanskelig du synes det er å utføre aktiviteten!*

Aktivitet:	Dato	Grad
1		
2		
3		
4		
5		

Grad av vanskelighet:

0 1 2 3 4 5 6 7 8 9 10

Kan utføre aktiviteten uten vanskelighet eller som før sykdommen

Kan ikke utføre aktiviteten

Ved oppfølginger (Les tekst i kursiv)
– Når vi møttes sist den… (angi dato) *ga du uttrykk for at du hadde vansker med å ….*
– Har du idag fremdeles vansker med 1…, 2…, 3…evt….4…..5..?
Les opp en aktivitet ad gangen og be pasienten angi på samme skala et tall for hvilken grad av vansker han/hun har med å utføre aktuelle aktivitet nå. Fyll i tabellen.

Grad av vanskelighet:

0 1 2 3 4 5 6 7 8 9 10

Kan utføre aktiviteten uten vanskelighet eller som før sykdommen

Kan ikke utføre aktiviteten