

An investigation into potential differences in measurements of neck proprioception between asymptomatic subjects and those with cervical pain

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INTRODUCTION

Proprioception is a sense or knowledge of position, posture, equilibrium, or internal condition of the body. Specialized receptors in joints, skeletal muscles, tendons and skin provide information on body position and muscle action for coordinated motion.

Information regarding position and movement of the head in relation to the trunk is provided in part by neck proprioceptors.

By converging with vestibular and visual sensory information, neck proprioceptors influence vestibular reflexes and thus contribute to the stabilization of eye, head and body posture as well as the maintenance of proper spatial orientation to the environment.

If the visual and vestibular apparatus and the neck proprioceptors provide conflicting information, a sensory mismatch occurs between what is seen and felt. Injury to joint ligaments may cause direct or indirect alterations in sensory information from mechanoreceptors and proprioceptors.

Cervical injury, especially whiplash, can result in a variety of symptoms, including oculomotor dysfunction. This can be explained by alteration of the cervical proprioceptive system. Muscular and articular receptors are impaired as a result of trauma and this can affect afferent integration and motor output. Heikkila[1] showed that whiplash patients were less able to relocate initial head position involving all positions.

Palmgren et al.[2] examined head repositioning in patients with chronic non-traumatic neck pain versus controls and found a great variability in both groups. They also found that of the six cardinal directions tested, only flexion repositioning was less accurate in the experimental group.

The use of proprioception as a diagnostic indicator of degree of injury and for assessing the effects of therapy and rehabilitation should be further investigated. Building a proprioception database of normals, of those with generalized cervical pain and those with specific cervical pathologies is a necessary first step.

This pilot study is an attempt to start this process.

METHODS

Subject selection

We received University of Bridgeport Institutional Review Board approval for this research project.

All subjects recruited for this study were University of Bridgeport College of Chiropractic students or faculty. They were screened through history and physical examination for risks:[3]

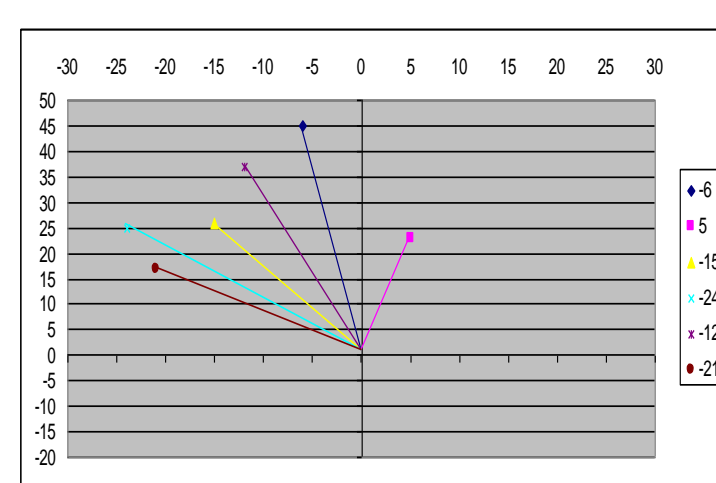
- History of cervical artery dissection or stroke
- Acute neck, occipital or head pain that is severe and unlike any previously experienced
- Active or existing vertebral artery disease as evidenced by at least 1 of 4 signs or symptoms of neurovascular impairment: unilateral paresthesia of the face, objective cerebellar defects, lateral medullary signs or symptoms or visual field defects
- Active cervical spine cord injury; Acute cardiac disease.

Subjects were required to sign an informed consent document before being accepted. We used two separate documents, one for those found to have risk factors and not eligible to participate and those with no known risk factors who are therefore eligible to participate. Subjects accepted for the study with no known risk factors were categorized:

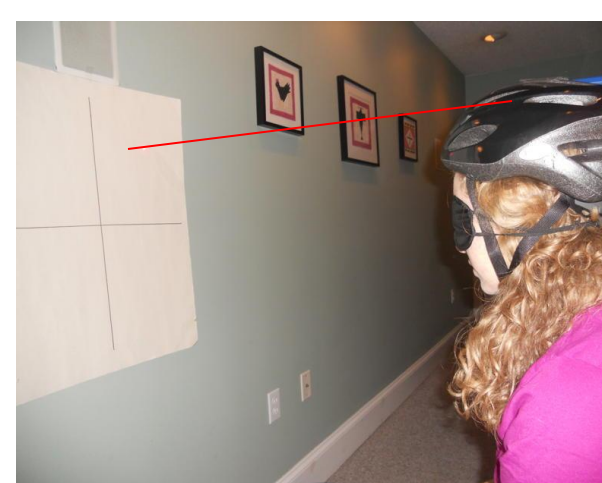
- currently have no neck pain and will not receive treatment for cervical spine disorders
- neck pain who are not currently receiving treatment for cervical spine disorders
- neck pain who are currently receiving treatment for cervical spine disorders.

Procedure for data collection

- Have the subject sit with neck in neutral position.
- Blindfold the subject, put helmet with laser pointer on subject, making sure it fits snugly. Have subject hold head still in a neutral position as if looking straight ahead and position subject so that laser pointer light appears on the blackboard ahead.
- Mark the starting (Neutral) point with an X.
- Have subject maximally flex the neck (with no visual cues) and then ask subject to try to return to starting point.
- Record measurements for Flexion (pt 1).
- Repeat for Extension, Left lateral flexion, Right lateral flexion, Left rotation, Right rotation (pts 2-6, respectively).
- Remove blindfold and helmet, wipe with disinfectant. Discharge subject from study.
- Measure the x and y coordinates in millimeters for each of the points (#1-6) and record these values along with neck pain/o neck pain/ treatment/no treatment status.



Example of data collected for 6 motions



Apparatus: LASER helmet*

*Our thanks to Michael Carucci, D.C., who designed and fabricated the LASER helmet

RESULTS

1. Overall cervical pain vs non-cervical pain

There is a trend for cervical pain patients to show greater deviation than non-pain subjects in 5/6 movements.

2. Cervical pain subjects treated for cervical pain vs non-cervical pain

The cervical pain group being treated for cervical pain showed a trend for less deviation in 5/6 movements when compared to the non-pain group

3. Cervical pain subjects not treated for cervical pain vs non-cervical pain

The cervical pain group not being treated for cervical pain consisted of only 4 subjects. In all 6 movements, this group showed less deviation than did the non-cervical pain group.

4. Cervical pain subjects being treated for cervical pain vs cervical pain subjects not being treated for cervical pain

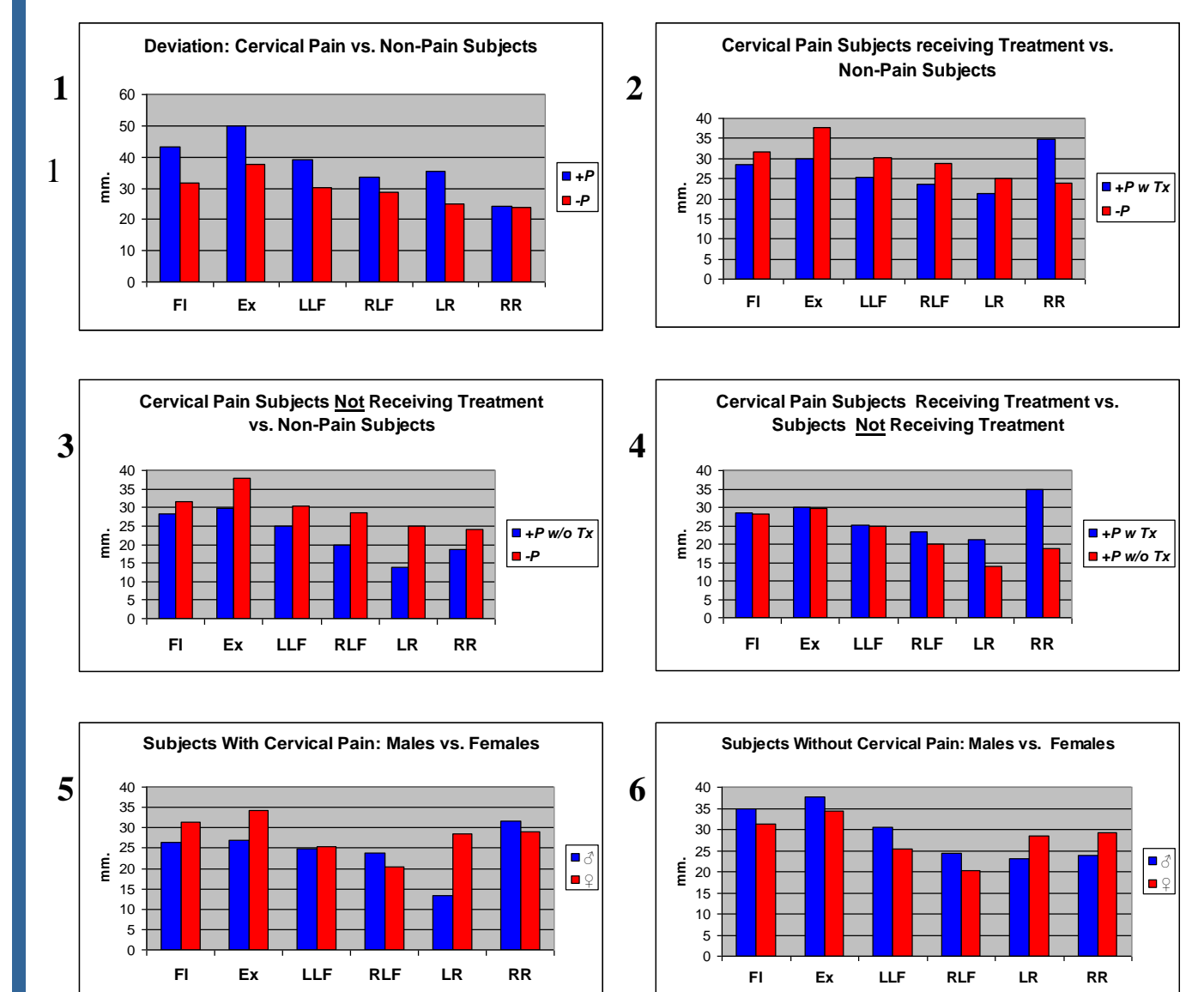
The cervical pain subjects not being treated for cervical pain demonstrated less deviation than did the cervical pain subjects being treated for cervical pain in 3/6 movements.

5. Male vs female cervical pain subjects

The male cervical pain group trials showed less deviation than did the female cervical pain group in 3/6 movements.

6. Male and female non-cervical pain subjects

The female group without cervical pain showed less deviation than did the male group in 4/6 movements.



DISCUSSION

Only 1 trial per subject was done. Initially, we felt that repeated trials might result in a learning response and affect results. The drawback to 1 trial only is the possible influence of outlying values.

CONCLUSION

The evidence from this pilot investigation and other studies suggests that compromised proprioception due to neck injury may be detected through accuracy variation in the ability to return to a neutral position. In this pilot study, statistically significant differences in the performance of the specified movements were not obtained, most likely resulting from a small sample size. Definitive trends were observed, however, between those subjects with cervical pain and those with pain who are receiving treatment and subjects who were pain free and were not receiving treatment. A noted difference between males and females was also identified. We propose that a larger study should be undertaken with subsets neck pain vs. no neck pain, and those with and without treatment.

1. Heikkala HV Wenngren B. Cervicocephalic kinesthetic sensibility, active range of cervical motion and oculomotor function in patients with whiplash injury. Arch Phys Med Rehabil 1998; 79:1089-1094.

2. Palmgren PJ, Andreasson D, Eriksson M, Hagglund A. Cervicocephalic kinesthetic sensibility and postural balance in patients with nontraumatic chronic neck pain- a pilot study. Chiropr and Osteopath 2009;17:6.

3. Anderson-Peacock E, Blouin JS, Bryans R, Danis N, Furlan A, Marcoux H et al. Chiropractic clinical practice guideline: evidence-based treatment of adult neck pain not due to whiplash. J Can Chiropr Assoc 2005;49:158-209.