Dr. Chestnut's Research Review

© The Wellness Practice May 2022 © Dr. James L. Chestnut M.Sc, D.C., C.C.W.P.

Effects of Cervical Manipulation on Elbow Position Sense

Haavik and Murphy (2011) Subclinical Neck Pain and the Effects of Cervical Manipulation on Elbow Joint Position Sense. Journal of Manipulative and Physiological Therapeutics Vol 34, No 2; 89-96.

ABSTRACT

"The objectives of this study were to investigate whether elbow joint position sense (JPS) accuracy differs between participants with a history of subclinical neck pain (SCNP) and those with no neck complaints and to determine whether adjusting dysfunctional cervical segments in the SCNP group improves their JPS accuracy."

"Results: At baseline, the control group was significantly better at reproducing the elbow target angle. The SCNP group's absolute error significantly improved after the cervical adjustments when the participants' heads were in the neutral and left-rotation positions. They displayed a significant overall decrease in variable error after the cervical adjustments. The control group participants' JPS accuracy was worse after the control intervention, with a significant overall effect in absolute and variable errors. No other significant effects were detected."

"Conclusion: These results suggest that asymptomatic people with a history of SCNP have reduced elbow JPS accuracy compared to those with no history of any neck complaints. Furthermore, the results suggest that adjusting dysfunctional cervical segments in people with SCNP can improve their upper limb JPS accuracy."

FULL REVIEW

INTRODUCTION:

"There is a growing body of evidence demonstrating that adjusting (also known as manipulating) dysfunctional spinal segments can alter central neural function. However, it is less certain whether these observed changes in central nervous system (CNS) processing reflect clinically beneficial changes to the individual participants. It has been suggested that these observed changes in sensory processing, sensorimotor integration, and motor control could reflect a mechanism that explains the functional improvements observed after chiropractic care."

"Our group has proposed that high-velocity, low-amplitude manipulation has a neuromodulatory effect on CNS function. Furthermore, we have proposed that segments of the spine where the movement is functionally restricted in at least 1 plane may represent an ongoing state of altered afferent input that could induce maladaptive neuroplastic changes."

This is important, they are stating that restricted joints and the subsequent altered proprioceptive input from such joints, represent an ongoing state of altered afferent input into the brain which could induce maladaptive neuroplastic changes (changes in the synapses in the sensorimotor cortex resulting in decreased neuromuscular function).

In August 2017 I reviewed the Lissek et al. 2009 paper (Lissek, S. et al. (2009) Immobilization Impairs Tactile Perception and Shrinks Somatosensory Cortical Maps. Current Biology 19, (10), 1-6) which conclusively showed

that restricted motion results in maladaptive changes to cortical maps resulting in sensorimotor dysfunction. Perhaps most importantly these authors showed that these changes were reversible when proper limb/joint motion was restored. Here are a few quotes: "We show that significant alterations due to immobilization are not limited to the motor system; in addition, tactile perception is impaired in parallel with a reduced activation in the somatosensory cortex."

"In the motor domain, immobilization induces severe muscle atrophy, as well as changes in motor cortex excitability, firing rates of human motor units, and contractile properties of skeletal muscles."

"Thus, our findings extend the theory of use-dependent plasticity as a determinant of brain organization by showing that reduced use induced by two weeks of immobilization reversibly affects perception in a maladaptive way in parallel with cortical reorganization."

Back to this paper.

"This functional putative manipulable lesion is known by a variety of terms such as joint dysfunction, fixation, or subluxation. It has been suggested in the literature that the maladaptive neuroplastic changes present in long-term pain conditions rather than the actual pain itself are responsible for the individual sufferer's symptoms and functional disturbances. In particular, changes in the way the CNS processes proprioceptive information have been suggested as the most important factor responsible for the clinical presentation of neck pain sufferers."

This is not well worded. Pain is pain whether it is generated from the periphery or in the cortex – pain is a cortical phenomenon, and it is an emotion or feeling which is "real" or "actual" regardless of the source. Pain is likely multifactorial, some certainly can be caused by changes in proprioceptive input, some from neuroplastic changes in the cortex, and some, of course, from tissue damage and inflammation induced nociception.

"One of our previous studies using somatosensory evoked potentials has shown that adjusting dysfunctional cervical segments of patients without frank neck pain but with a history of some form of subclinical neck pain (SCNP) can alter cortical somatosensory processing and early sensorimotor integration of input from the upper limb."

"Subclinical neck pain refers to recurring neck dysfunction such as mild neck pain, ache, and/or stiffness with or without a history of known neck trauma. Individuals with SCNP do not have constant symptoms and have not yet sought treatment of their neck complaint. There is an increasing interest in SCNP in the literature because individuals that fall into this category provide an opportunity to explore neurophysiologic dysfunction without the confounding effect of current pain, which is known to alter sensory processing and motor control."

It is important to remember that just because pain is not present does not mean that inflammation and nociception are not present. Inflammation and nociception most certainly can occur without conscious pain. It is not neurophysiologically accurate to assume that an absence of pain is a valid indication of an absence of tissue inflammation and/or nociceptive input into the CNS.

"It is possible that cervical spinal dysfunction disturbs proprioception from the neck and upper limb and that spinal adjustments improve it. Palmgren et al. demonstrated that chiropractic care can improve head

repositioning accuracy, which is an indicator of improved proprioception, suggesting that spinal adjustments can improve spinal proprioception."

"A recent study takes the work of Palmgren et al. a step further, as it suggests that cervical spine function can influence upper limb proprioception. Knox and Hodges demonstrated that changes in head and neck position in a group of participants without any history of neck pain or injury led to reduced accuracy of elbow joint position sense (JPS). The authors of this study discussed how accurate execution of movement depends on the ability of the CNS to integrate somatosensory, vestibular, and visual information regarding the position of the body. They argued that placing their participants' heads in full flexion and rotation could have led to an overload of the computational capacity of the CNS, thus resulting in increased JPS error."

"The same group of researchers also demonstrated that people with whiplash-associated disorder (WAD) are affected by smaller angles of neck rotation than individuals who had no history of WAD, further suggesting that cervical spine dysfunction leads to reduced accuracy of JPS."

"Taken together, these studies suggest that spinal function can impact central proprioceptive processing not only of the spine itself, as the study of Palmgren et al. suggests, but also of the upper limb. It is therefore possible that the changes in the N20 SEP peak after spinal adjustments of dysfunctional cervical segments (from an earlier Haavik study) could reflect such changes in proprioceptive processing of the upper limb."

"The aims of the current study were therefore to investigate whether JPS accuracy differs between SCNP participants and those with no history of any neck symptoms or injury and to determine whether manipulating (adjusting) dysfunctional cervical segments in the SCNP group can improve the accuracy of their elbow JPS."

METHODS

"Twenty-five participants (10 women, 15 men; average age, 25.7 ± 4.3 years) with a self-reported history of subclinical neck pain but with no acute neck symptoms on the day of recording were recruited for the cervical adjustment experiment."

"Data from 18 participants (13 women, 5 men; average age, 23.2 ± 9.5 years) with no history of any neck complaint or injury were used as a comparison group to compare the 2 groups' preintervention data."

The protocol was to measure elbow joint position sense, then either adjust areas of joint dysfunction/vertebral subluxation complex (restricted/tender joints) for the intervention group or a 5 minute rest for the control group, then remeasure elbow joint position sense.

"The SCNP participant's spines were assessed for the presence of cervical joint dysfunction by a registered chiropractor with at least 8 years of clinical experience. This was detected in the following manner: the examiner passively moved the participants' head while palpating and stabilizing over the zygapophyseal joints. For each spinal segment, the head was gently and passively moved from neutral position to the maximal range of lateral flexion in the coronal plane to both the left and the right. If this movement appeared restricted, the examiner applied gentle pressure to the joint while watching for signs of discomfort from the participant."

"The examiner also asked the participant if the pressure to the joint elicited pain and/or tenderness. Cervical segments that were deemed both restricted in lateral flexion range of motion and elicited pain on palpation

were noted down for the cervical adjustment intervention. For the purpose of this study, dysfunctional segments were defined as the presence of both palpable restricted intersegmental range of motion and tenderness to palpation of the joint because these criteria have been shown to have acceptable reliability in the literature for the cervical spine."

Two VERY IMPORTANT things to note here. One, the most valid and reliable clinical examination to determine the presence of VSC or joint dysfunction, and thus the clinical need for chiropractic adjustment/SMT, is palpation and communication with patient to determine restricted, tender joints. This is EXACTLY why I use this protocol for my SHA (Spinal Health Exam and Report). Pain is NOT a valid or reliable clinical indicator of the presence of VSC/joint dysfunction or the clinical indication for adjustment/SMT and absence of pain is NOT a valid indicator of the absence of VSC/joint dysfunction or the absence of clinical indication for chiropractic adjustment/SMT. HUGELY IMPORTANT!

Two, the fact that a joint is tender to palpation is evidence of allodynia, that both chronic inflammation and nociception are present, thus the hypothesis that the only issue is altered proprioceptive input cannot be defended.

"Elbow JPS was measured using a task that requires the participant to reproduce a previously presented angle of the elbow joint, as was done by Knox and Hodges. This methodology has been used in several previously published studies including a pre-post experimental design similar to the one used for this study and is a valid and reliable method for measuring JPS."

"Six trials for each of the following head positions were conducted with randomly preselected midrange elbow angles: (1) neutral (control position), (2) left rotation, (3) flexion, and (4) combined flexion and left rotation. For each of these positions, the participant's head was passively placed in the target position by the experimenter and kept in this position with the aid of various pillows during the active reproduction of the elbow joint target angle. For each of the head positions 2 to 4, the head and neck was taken almost to the end of each participants' range of motion."

"Elbow joint angle was measured using an electrogoniometer (MLTS700; ADInstruments, Dunedin, New Zealand)."

"The cervical adjustment interventions carried out in this study were all high-velocity, low-amplitude thrusts to the spine held in lateral flexion with slight rotation and slight extension. The mechanical properties of this type of CNS perturbation have been investigated, and although the actual force applied to the participants' spine depends on the therapist, the patient and the spinal location of treatment, the general shape of the force-time history of spinal manipulation is very consistent, and the duration of the thrust is always less than 200 milliseconds."

"The high-velocity type of adjustment was chosen specifically because previous research has shown that reflex EMG activation observed after adjusting the spine only occurred after high-velocity, low amplitude manipulations (as compared to lower velocity mobilizations) and would therefore be more likely to alter afferent input to the CNS and lead to measurable JPS changes. This particular type of CNS perturbation has also been used previously to demonstrate central plastic changes."

VERY IMPORTANT. The idea put forward that non-thrust mobilizations and thrust adjustments/SMT are synonymous is provably false. Yet, non-thrust mobilizations are now referred to as SMT in the literature and the results from these studies are pooled with the results of thrust SMT/adjustment studies. The result is that the benefits from thrust adjustment/SMT studies get downgraded.

RESULTS

"The multifactorial repeated measures ANOVA assessing any effect from the cervical adjustments revealed a significant interactive effect for the factors TIME, GROUP, and HEAD POSITION and for TIME and GROUP. Further analysis of the SCNP group data revealed an overall effect for TIME and a significant interactive effect for the factors TIME and HEAD POSITION."

In other words, cervical thrust adjustments/SMT improved joint position sense. This was almost certainly due to the fact that these adjustments improved proprioceptive input into the sensorimotor cortex and thus improved sensorimotor integration and control allowing for better limb position sense.

However, it is equally likely that the adjustments also resulted in a decrease in nociceptive input (proprioception inhibits nociception) which could also affect sensorimotor control. This absolutely can occur in the absence of conscious pain.

DISCUSSION

"The major findings in this study were that participants with a self-reported history of subclinical neck pain have significantly worse elbow JPS compared to people that have no neck complaints and that a single session of high velocity, low-amplitude adjustments of dysfunctional cervical joints resulted in a significant improvement of elbow JPS."

"Previous research has demonstrated that both perceived and actual head and neck positions can influence the accuracy of elbow JPS. Thus, the body's internal reference framework appears to be very important for accurate integration of incoming proprioceptive information."

"There is evidence in the literature to suggest that muscle impairment occurs early in the history of onset of neck complaints and that this muscle impairment does not automatically resolve even when neck pain symptoms improve. Some authors have therefore suggested that the deficits in proprioception and motor control rather than the pain itself may be the main factors defining the clinical picture and chronicity of different long-term pain conditions."

Again, deficits in proprioception and motor control can most certainly occur in the absence of pain, and, conversely, can also result in the sensation of pain. However, this does not rule out the presence or contribution of inflammation and nociception. In fact, as I pointed out earlier, the fact that joints were tender to palpation (allodynia) is indication that chronic nociception was present and that these nociceptive pathways were sensitized due to chronic firing. Chronic joint and tissue inflammation results in chronic nociception which leads to sensitization and allodynia. This can all be occurring in the absence of pain.

"The finding that the SCNP participants have significantly worse JPS accuracy compared to participants with no history of any neck complaint supports this hypothesis. The current study results suggest that deficits in

proprioception identified in the SCNP group may be partly due to the presence of the type of spinal dysfunction that chiropractors and other manipulative therapists treat."

"The cervical adjustment intervention improved the SCNP participants' elbow JPS accuracy to a similar level as that of the control group and to what has previously been reported in the literature in asymptomatic healthy populations with no history of head or neck symptoms or injuries. This supports the theory that chiropractic care can have a beneficial neuromodulatory effect."

"The improvements we observed might be even more impressive in a group with a greater level of pain and disability because some authors have observed larger repositioning errors in persons reporting worse functional disability scores than those with milder problems."

"It is also possible that the putative "manipulable lesion," also known as "vertebral subluxation" or "dysfunctional spinal joint segment," may represent a state of altered afferent input that may be responsible for ongoing central plastic changes. It is well established that altered afferent input to the CNS leads to changes in CNS functioning."

"Thus, as previously postulated, a potential mechanism that could explain how manipulation improves function is that altered afferent feedback from a dysfunctional neck or spine alters the afferent "milieu" into which subsequent afferent feedback from the spine and limbs is received and processed thus leading to altered sensorimotor integration of the afferent input, which is then normalized by high-velocity, low-amplitude adjustments of the dysfunctional areas of the spine."

And again, let's not forget that SMT/adjustment can reduce nociception!

CONCLUSION

"The results of this study suggest that asymptomatic people with a history of recurring neck pain, stiffness, or ache have reduced elbow JPS accuracy compared to those with no history of any neck complaints. Furthermore, the results suggest that even a single session of adjusting dysfunctional cervical segments in people with subclinical neck pain can improve their upper limb JPS accuracy."

"Practical Applications

• The results of this study suggest that asymptomatic people with a history of recurring neck pain, stiffness, or ache have reduced elbow JPS accuracy compared to those with no history of any neck complaints.

• Spinal manipulation (adjustments) delivered to dysfunctional cervical segments in people with subclinical neck pain improved upper limb JPS accuracy in this group.

• These findings support the concept that neck joint dysfunction can impair the way proprioceptive input from the upper limb is processed and provides evidence that this can be improved by cervical spine manipulation.

• This study supports previous research that suggests that altered sensory processing and motor control may be implicated in the development of chronic and recurrent neck pain."

**Important to note that the way neck adjustments are improving limb position sense, and have been shown to improve motor control and strength, is not by affecting nerve flow at the spinal cord - though the central cervical nucleus could certainly be affected by adjustments - but by improving sensori-motor integration in the cortex. In other words, chiropractic adjustments improve sensory input that is required for proper brain function and thus the brain is able to receive and integrate proprioceptive information at a higher functional level and, because of this, to have greater neuromuscular motor control.*

To put it simply, the safety pin cycle (sensory input – brain processing – motor output) is sensory input dependent and adjustments improve the sensory input (proprioception) which enables improved brain processing (sensory awareness and sensori-motor integration) and improved neuromuscular function (motor control).

Adjustments don't put out of place bones that are putting pressure on nerves back into place and relieve nerve pressure; adjustments restore motion which restores the all-important proprioceptive sensory input of the safety pin cycle.

As I have described in several previous Research Reviews, adjustments can also break up scar tissue, reduce inflammation, and reduce nociception which also has profound effects.

I would be most grateful if you see enough value in these Research Reviews to recommend them to a colleague.

Please go to www.thewellnesspractice.com or www.innatechoice.com to get a FREE SAMPLE of my Evidence-Based Spinal Health Assessment (SHA) and Report and a preview of my Evidence-Based Chiropractic and Lifestyle Protocols practice systems, including the Innate Choice® Essential Nutrient System™. See for yourself how easy and inevitable success can be when you follow the right protocols and systems. You can also call Dr. Richard Baxter at 250-381-2084 ext 2 and he will be happy to answer any questions or provide any assistance. If you would like to speak with me, you can arrange that through Dr. Baxter as well.

We are happy to provide a free month trial of our protocols for anyone interested.

Read and practice well my esteemed, evidence-based, ethical, learned expert chiropractic colleagues.

Talk to you next month.

Dr. C