

Neck muscle fatigue affects postural control in man

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FROM ABSTRACT:

We hypothesized that, since anomalous neck proprioceptive input can produce perturbing effects on posture, neck muscle fatigue could alter body balance control through a mechanism connected to fatigue-induced afferent inflow.

18 normal subjects underwent fatiguing contractions of head extensor muscles.

Sway during quiet stance was recorded by a dynamometric platform, both prior to and after fatigue and recovery, with eyes open and eyes closed.

After each trial, subjects were asked to rate their postural control. Fatigue was induced by having subjects stand upright and exert a force corresponding to about 35% of maximal voluntary effort against a device exerting a head-flexor torque.

The first fatiguing period lasted 5 min (F1). After a 5-min recovery period (R1), a second period of fatiguing contraction (F2) and a second period of recovery (R2) followed.

Surface EMG activity from dorsal neck muscles was recorded during the contractions and quiet stance trials. EMG median frequency progressively decreased and EMG amplitude progressively increased during fatiguing contractions, demonstrating that muscle fatigue occurred.

After F1, subjects swayed to a larger extent compared with control conditions, recovering after R1. Similar findings were obtained after F2 and after R2.

Although such behaviour was detectable under both visual conditions, the effects of fatigue reached significance only without vision.

Subjective scores of postural control diminished when sway increased, but diminished more, for equal body sway, after fatigue and recovery. Contractions of the same duration, but not inducing EMG signs of fatigue, had much less influence on body sway or subjective scoring.

We argue that neck muscle fatigue affects mechanisms of postural control by producing abnormal sensory input to the CNS and a lasting sense of instability.

Vision is able to overcome the disturbing effects connected with neck muscle fatigue.

Abbreviations:

EC, eyes closed

EO, eyes open

F1, first fatiguing period

F2, second fatiguing period

R1, first recovery period

R2, second recovery period

THESE AUTHORS ALSO NOTE:

"There are many indications that the afferent input from neck muscles play a role in the control of stance and locomotion."

"Studies using natural neck proprioceptive stimulation (head rotation relative to the trunk) have shown that neck afferent inflow is important in perceiving not only head posture but also motion and localization of visual objects."

"Neck muscle vibration also modifies the representation of visual motion and direction."

"The above effects may be linked to a cervical proprioceptive input to the brain stem nuclei which also control posture, e.g. the vestibulo-spinal nuclei."

"Vestibular-proprioceptive interactions play a role in self-motion perception in addition to postural control."

"There are indeed suggestions that abnormal cervical inflow may cause dizziness or imbalance, sometimes termed 'cervical vertigo'."

Abnormal head posture can trigger episodes of dizziness. **[IMPORTANT]**

"It is therefore possible that the cause of imbalance is not the pathological process per se, but the consequences of such a process that may occur under particular circumstances." **[Like Subluxation Complex]**

Abnormal head position could cause appearance of dizziness through a mechanism connected to an abnormal afferent inflow. **[Chiropractic Nerve Interference]**

Muscle fatigue can affect perception of body segment position.

Neck muscle fatigue could be a cause of poor stance control.

These authors produced fatigue in normal subjects by intense, prolonged isometric contraction of the dorsal neck muscle, and prior to and immediately after this procedure we recorded the body sway during stance.

They concluded that neck muscle fatigue produces an increase in body sway accompanied by a feeling of instability.

In this study, 18 healthy subjects with a mean age 35.5 years were assessed.

Balance assessment (sway) was evaluated using a dynamometric platform **[we have this equipment at Life Chiropractic College West]** with eyes open (EO) and with eyes closed (EC). Assessments were made before and after neck muscle fatiguing.

DISCUSSION

Body sway during quiet stance is significantly increased after 5 min of intense contraction of dorsal neck muscles.

After neck muscle fatigue, the quietly standing subjects swayed more than before.

It is likely that vision can have an important stabilizing effect, capable of overcoming the disturbing effects connected with the neck muscle fatigue and related abnormal sensory inflow.

[This has an important clinical application to chiropractic: subluxation complex with nerve interference (abnormal sensory inflow) causes postural distortions and stability problems. Vision can override the assessment of the postural and stability problems. This would argue that the best assessment of the postural and stability problems associated with subluxation complex and abnormal sensory inflow nerve interference would require the eyes to be closed. This is consistent with the postural analysis made by those who practice Chiropractic Biophysics Technique, and probably some other techniques as well. Once again, we have this equipment at Life Chiropractic College West. I was the first subject to be tested at Life Chiropractic West for postural stability with eyes open verses eyes closed. The technology of these devices to assess the effects of altered proprioceptive neurology (subluxation complex with nerve interference) on postural stability is astonishing. Currently, Life Chiropractic College West is not only documenting these subtle neurological pathologies, but they are also assessing their improvement as a consequence of various approaches of chiropractic management.]

“Vision certainly has an impact on stance control.”

In this study, vision was enough to cancel the disturbing effects connected to neck muscle fatigue.

These authors also concluded that low-level contractions were insufficient to cause muscle fatigue and unable to produce major effects on postural stance.

“Therefore, we would argue that localized neck muscle fatigue may affect central mechanisms of postural control by producing an input to the CNS.”

“Anomalous sensory input [**chiropractic nerve interference**] may be the result of an increased inflow from the free nerve endings as a consequence of ionic or metabolic changes (elevated interstitial potassium concentration) or insufficient oxygen availability due to reduced blood flow.”

Interestingly, cervical pain input is able to significantly alter postural control.

Abnormal muscle spindle inflow could perturb and deteriorate postural control.
[IMPORTANT]

“Neck muscle fatigue may be directly responsible for abnormal inputs disturbing the subjective postural reference.”

Some individuals have a more “fragile nervous mechanism,” and are “easily disturbed by minimal alterations in sensory inflow.” **[This would imply that there are differences as to an individual’s response to the same subluxation and recovery rates from spinal adjusting]**

“The afferent discharge from the neck might play a dominant role in calibrating all other sensory inputs.” **[WOW, VERY IMPORTANT]**

“An anomalous inflow and the consequent incongruent central integration of it might be one of the factors contributing to dizziness.” **[IMPORTANT]**

KEY POINTS FROM DAN MURPHY

- 1) I believe that what chiropractors refer to as nerve interference is what these authors term "anomalous neck proprioceptive input," and "abnormal sensory input to the CNS."
- 2) Anomalous neck proprioceptive afferent inflow produces perturbing effects on posture and can alter body balance control.
- 3) Afferent input from neck muscle plays a role in the control of stance and locomotion.
- 4) Afferent inflow is important in perceiving head posture, motion and localization of visual objects.
- 5) Cervical proprioceptive input goes to the brain stem vestibulo-spinal nuclei, which controls posture.
- 6) Abnormal cervical afferent inflow may cause dizziness or imbalance, sometimes termed cervical vertigo.
- 7) Consequently, abnormal head posture can trigger dizziness.
- 8) Abnormal head position could cause of dizziness through a mechanism connected to an abnormal afferent inflow.
- 9) Vision is capable of overcoming the disturbing effects of abnormal sensory inflow from the neck. This would argue for the necessity to evaluate postural subluxations with the eyes closed, as noted in this article.
- 10) Abnormal muscle spindle inflow could perturb and deteriorate postural control. Abnormal muscle spindle afferent inflow is important in chiropractic explanations and management of the subluxation complex.
- 11) Some individuals have a more fragile nervous mechanism, and are easily disturbed by minimal alterations in sensory inflow. This would imply that there are differences as to an individual's response to the same subluxation.
- 12) Afferent discharges from the neck might play a dominant role in calibrating all other sensory inputs. **[MOST IMPORTANT!]**
- 13) This is another study where surface EMG is used as acceptable assessment of alterations of muscle tone.
- 14) Life Chiropractic College West has the equipment to do this type of sensitive testing for chiropractic nerve interference.