Dizziness, Unsteadiness, Visual Disturbances, and Postural Control: Implications for the Transition to Chronic Symptoms After a Whiplash Trauma

Spine
December 1, 2011; Volume 36, Number 25S, pp. S211–S217

Julia Treleaven, PT, PhD

FROM ABSTRACT:

The signs and symptoms of postural control disturbance may contribute to the transition to chronicity after a whiplash trauma.

Dizziness is one of the most frequent complaints in those with persistent pain after a whiplash trauma and is often associated with postural control disturbances.

Contemporary literature suggests that dizziness and postural control disturbance is often associated with significant neck pain and disability and are related to a poorer prognosis.

There are obvious links between the cervical proprioceptors and the musculoskeletal system, the autonomic nervous system, vestibular and visual systems, and they influence pain.

Postural control may alter other systems and affect pain and influence the transition to chronicity after a whiplash trauma.

Future research should address what abnormal cervical afferent input has on not just dizziness and postural control but other symptoms such as altered pain processing and psychological distress.

The causes of transition into chronicity after a whiplash trauma are present early and include pain sensitivity, psychosocial distress, postural deficits and dizziness.

THIS AUTHOR ALSO NOTES:

1) 10 - 40% of those sustaining whiplash trauma will develop chronic problems.

2) “After pain, dizziness, and unsteadiness are the next most frequent complaints in those with persistent problems after a whiplash trauma.” 70% of those with chronic whiplash symptoms have these complaints.

3) Chronic whiplash symptom patients may also have visual complaints including blurred vision.
4) Dizziness, unsteadiness and visual problems are likely caused by a mismatch of “afferent input from the proprioceptive, visual, and or vestibular systems to the postural control system.” These afferent mismatch problems may be a factor in the persistence of chronic whiplash symptoms. [This is consistent with the chiropractic subluxation and adjustment]

“There is reasonable evidence to suggest that the disturbances are primarily of a cervical proprioceptive origin from functionally impaired neck joint and muscle receptors.” “The disturbances to postural control and reflex activity are thought to arise primarily because of altered cervical afferent input to the postural control system.” “Alterations to cervical afferent input can subsequently change the integration, timing and tuning of postural control.” “Secondary impairment of vestibular and visual system functioning might also occur.”

5) Humans must have sound background posture to efficiently carry out tasks and to stabilize the trunk/neck for efficient eye and limb movements.

6) Impaired postural control leads to:
   • Altered head and upper limb position sense
   • Altered head and upper limb movement sense
   • Jerky, uncoordinated, irregular head movements
   • Problems in functional walking tasks
   • Altered smooth pursuit eye movement control
   • Altered gaze stability
   • Altered eye-head coordination

7) Whiplash injured patients often have altered visual and vestibular reflexes.

8) Afferent information from the cervical receptors, especially the muscle spindles, can be altered by:
   • Direct trauma
   • Impaired muscle and joint function
   • Morphological changes such as fatty infiltrate (especially in the deep suboccipital muscles where there is an exceptionally high percentage of muscle spindles).

9) Trauma releases inflammatory molecules that will activate joint and muscle afferents and alter muscle spindle activity.

10) Whiplash trauma can cause psychological distress via several mechanisms. Psychological distress activates the sympathetic nervous system that alters cervical muscle spindle activity [there is evidence that the intrafusal fibers of the muscle spindle are innervated by post-ganglionic sympathetic efferents].
11) Altered spindle activity alters proprioceptive influence of muscle and joint mechanics, effecting cervical afferent input to the postural control system. This in turn may influence reflex connections to the visual and vestibular systems.

12) “A decrease in non-nociceptive input may be a factor perpetuating pain, as non-nociceptive input normally has an inhibitory effect on pain modulation.” [This is the 1965 Gate Theory of Pain and consistent with the chiropractic subluxation and adjustment]

13) Whiplash injury to the cervical spine can cause “immediate and sustained alteration in somatosensory function” which leads to “secondary impairment of the vestibular and visual systems.” These secondary impairments in the vestibular and visual systems may themselves become persistent as a consequence of adaptive changes in the postural control system.

14) The management of dizziness and altered postural control after a whiplash injury should include:
   • Addressing the causes of altered cervical afferent input: pain, stress, altered neuromuscular control, altered muscle spindle sensitivity, etc.
   • Addressing the adaptive changes in the postural control system.

Cited studies to accomplish this include:
   • muscle exercise
   • acupuncture
   • “manual therapy demonstrated a decrease in dizziness”
   • exercise to improve gaze stability, eye-head coordination, and head on trunk relocation
   • eye head coupling and coordination exercises

15) NSAIDs (topically applied) improved pain but not dizziness.

16) “Manual therapy and acupuncture improves postural control via improvements in deep muscle spindle sensitivity.”

17) “There is also evidence that an exercise program, combining manipulation, proprioceptive neuromuscular facilitation, acupressure, and ROM exercises, intertwined with exercises to improve head relocation accuracy was efficacious for neck pain.”

18) Whiplash injured patients with symptoms of dizziness and unsteadiness and disturbances to the postural control system have a poor recovery prognosis:
   • In one study, all subjects with eye movement dysfunction on the first assessment soon after whiplash trauma had persistent disabling symptoms 8 months later; 80% of subjects with normal eye movement function on initial testing recovered fully or only had minor discomfort 8 months later.
• Following whiplash injury, high pain levels, dizziness and visual disturbances are factors associated with initial and persistent depression.

• High pain levels and the presence of dizziness are predictors of a poorer outcome after a whiplash trauma.

19) Postural control deficits alter somatosensory inputs and joint mechanics, and decreased descending inhibition of pain, contributing to chronic pain sensitization.

20) “There is potential for a vicious cycle of cervical dizziness, pain, anxiety, altered sympathetic nervous system function, and thus further altered cervical afferent input and increased dizziness because of links between the cervical afferents and the sympathetic nervous system via its influence on the cervical muscle sensitivity.” [Important]

21) The vestibular and autonomic systems are neurologically linked, and vestibular disturbance can alter autonomic tone and cause anxiety.

CONCLUSION

22) There are important links between the cervical proprioceptors and:
• the musculoskeletal system
• the autonomic nervous system
• the vestibular system
• the visual systems
All of these may influence pain modulation

23) “Management of altered postural control may have potential to alter other systems and affect pain and should be considered as one of the processes that might influence the transition to chronicity after a whiplash trauma.”

24) Abnormal cervical afferent input does not only affect dizziness and posture, but also pain and psychological distress.

[This is consistent with the chiropractic subluxation]
KEY POINTS FROM DR. TRELEAVEN:

1) Dizziness and altered postural control after whiplash results in a poorer prognosis.

2) Cervical proprioceptors are linked to the autonomic nerves, vestibular and visual systems, and influence pain. [Important]

3) Altered postural control may affect pain and influence the transition to chronicity after a whiplash trauma.

COMMENTS AND CONCERNS FROM DAN MURPHY

I viewed this study as quite important because it emphasized how trauma alters the mechanoreceptive afferent input into the central neural axis and how this altered mechanoreception adversely affects the physiology of multiple systems; this is consistent with chiropractic subluxation, nerve interference, and adjustment. It also supports that subluxation influences multiple systems and not just musculoskeletal aches and pains. I was particularly impressed that Dr. Treleaven included activation of sympathetic autonomic function in her cascade, but I was disappointed that she did so only as a consequence of anxiety/stress. Dr. Treleaven did not discuss:

1) The Henry Winsor study which showed that regional spinal stiffness [altered mechanoreception] causes regional increased sympathetic activity, eventually leading to visceral pathology.

2) The studies of Princeton physiologist Irvin Korr showing that segmental spinal dysfunction [altered mechanoreception] results in increased sympathetic tone, becoming the common factor in visceral disease.

3) The study by Jiang proving that segmental ligament mechanical stimulation altered the segmental firing of the sympathetic nervous system.

4) The studies by Ian Edwards showing asymmetry of the mechanoreceptors of the upper cervical spine significantly influence the parasympathetic communication with the viscera through the nucleus tractus solitarius.

5) The studies by Bill Yates that show a direct link between the vestibular nucleus and the sympathetic nervous system’s ability to influence cardiovascular function.

Etc., and there are many other examples that we have reviewed over the past 12 years.
Postural Control Disturbance

Altered Afferent Integration and Tuning

Visual System → Altered Cervical Somatosensory Input → Vestibular System

Sympathetic Nervous System Activation → Altered Mechanoreception

Spindle sensitivity

Pain → Functional Impairment

Inflammation → Decreased Range of Motion

Trauma