



BRAIN HUB

Dizziness & Concussion Clinic

Cervicogenic Dizziness: look above C1

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Thank you



**AUSTRALIAN
CHIROPRACTORS
ASSOCIATION**

A Little About Me...

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- Clinic Director of Brain Hub – *changing lives through neuroplasticity* (Sydney)
- PhD in Vestibular Rehabilitation at Neuroscience Research Australia (NeuRA) and University of New South Wales (UNSW)
- Honorary Post-Doctorate Researcher : NeuRA
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- Lecturer in clinical neuroscience and vestibular neuro-rehabilitation



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Dizziness

Described as the sensation of disturbed or impaired spatial orientation without a false or distorted sense of motion.

Bisdorff et al. Classification of vestibular symptoms: towards an international classification of vestibular disorders. *J Vestib Res* 2009; 19(1–2):1–13.



Prevalence – is dizziness common?

In US,

- 8 million primary care visits annually
- #1 reason for someone over 65 to consult a MD
- 35% of adults aged 40 years or older in the US, have experienced some form of vestibular dysfunction Arch Intern Med. 2009 May 25;169(10):938-44
- A self reported questionnaire of nearly 3000 people (18-86 years), showed the 1-year prevalence for vertigo was 48.3%, for unsteadiness 39.1%, and for dizziness 35.6%.

frontiers in
NEUROLOGY

ORIGINAL RESEARCH ARTICLE
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doi: 10.3389/fneur.2013.00029



The epidemiology of vertigo, dizziness, and unsteadiness
and its links to co-morbidities

Alexandre Bisdorff^{1,2*}, Gilles Bosser^{1,3}, René Gueguen^{1,4} and Philippe Perrin^{1,5}

Causes of dizziness

There are many different causes of dizziness, including

- Vestibular (peripheral and central)
- Cardiorespiratory
- Neurological
- Mental/psychiatric
- Cervical
- Medication
- Systemic conditions



Cervical-Related Dizziness

Cervical-related dizziness can be divided further into dizziness caused by

1. altered blood flow in the cervical arterial blood vessels, either by compression (e.g. vertebrobasilar insufficiency) or disruption (e.g. sympathetic plexus induced vasoconstriction)
2. altered functioning of the cervical proprioceptors - **cervicogenic dizziness (CGD)**



Defining Cervicogenic Dizziness (CGD)

Cervicogenic dizziness (CGD) is a clinical syndrome characterized by the presence of dizziness and associated neck pain, as well as the presence of

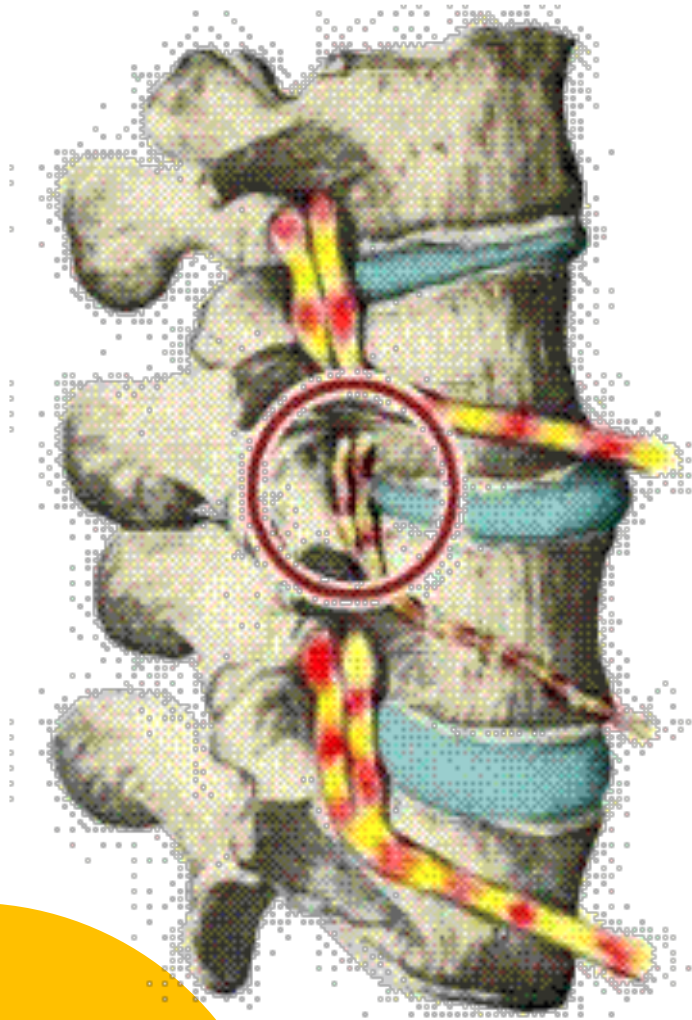
- Imbalance
- Unsteadiness
- Disorientation
- neck pain,
- limited cervical range of motion (ROM)
- may be accompanied by a headache

Cervicogenic Dizziness (CGD)

There are no definitive clinical or laboratory tests for CGD and therefore **CGD is a diagnosis of exclusion.**

It can be difficult for healthcare professionals to differentiate CGD from other vestibular, medical and vascular disorders that cause dizziness.

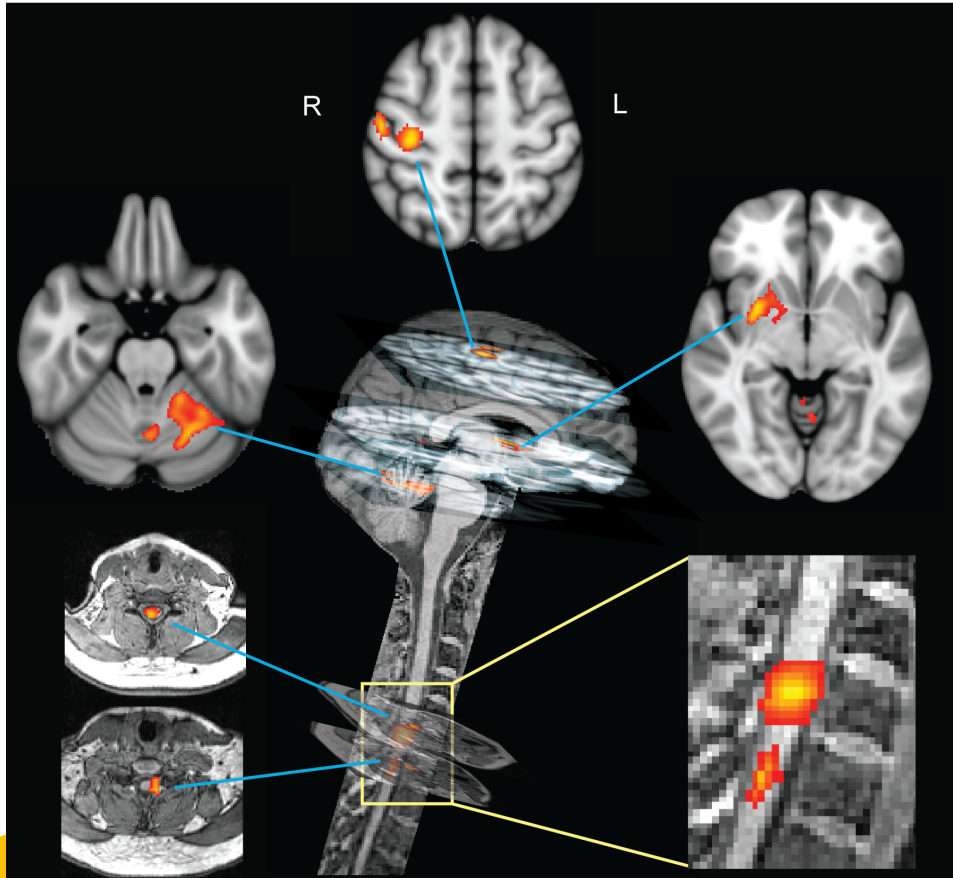
It requires a high level of skill and a thorough understanding of the proper tests and measures to accurately rule in or rule out competing diagnoses.



What is the cause of CGD?

Bone out place?

Bone on nerve, blocking the innate?



What's a contemporary
view point of CGD?

First Principles First

Know and be guided by your
neuroanatomy and neurophysiology

RESEARCH ARTICLE

Open Access

Reliability, construct and discriminative validity of clinical testing in subjects with and without chronic neck pain

René Jørgensen^{1,2*}, Inge Ris², Deborah Falla^{3,4} and Birgit Juul-Kristensen^{2,5}

Abstract

Background: The reliability of clinical tests for the cervical spine has not been adequately evaluated. Six cervical clinical tests, which are low cost and easy to perform in clinical settings, were tested for intra- and inter-examiner reliability, and two performance tests were assessed for test-retest reliability in people with and without chronic neck pain. Moreover, construct and between-group discriminative validity of the tests were examined.

Methods: Twenty-one participants with chronic neck pain and 21 asymptomatic participants were included. Intra- and inter-reliability were evaluated for the Cranio-Cervical Flexion Test (CCFT), Range of Movement (ROM), Joint Position Error (JPE), Gaze Stability (GS), Smooth Pursuit Neck Torsion Test (SPNTT), and neuromuscular control of the Deep Cervical Extensors (DCE). Test-retest reliability was assessed for Postural Control (SWAY) and Pressure Pain Threshold (PPT) over tibialis anterior, infraspinatus and the C3-C4 segment.

Results: Intraclass Correlation Coefficient (ICC) for intra- and inter-examiner reliability was highest for ROM (range: 0.80 to 0.94), DCE (0.75 to 0.90) and CCFT (0.63 to 0.86). JPE had the lowest ICC (0.02 to 0.66). Intra- and inter-reliability for GS and SPNTT showed kappa ranging from 0.66 to 0.92, and 0.57 to 0.78 (prevalence adjusted), respectively. For the test-retest study, ICC was 0.83 to 0.89 for PPT and 0.39 to 0.79 for SWAY. Construct validity was satisfactory for all tests, except JPE. Significant between group discriminative validity was found for CCFT, ROM, GS, SPNTT and PPT, however, differences were within the limits of the minimal detectable change.

Conclusions: The majority of the tests evaluated showed satisfactory reliability and construct validity supporting their use in the clinical evaluation of patients with chronic neck pain.

Keywords: Neck pain, Reliability, Validity assessment

People with cervicogenic problems present with...

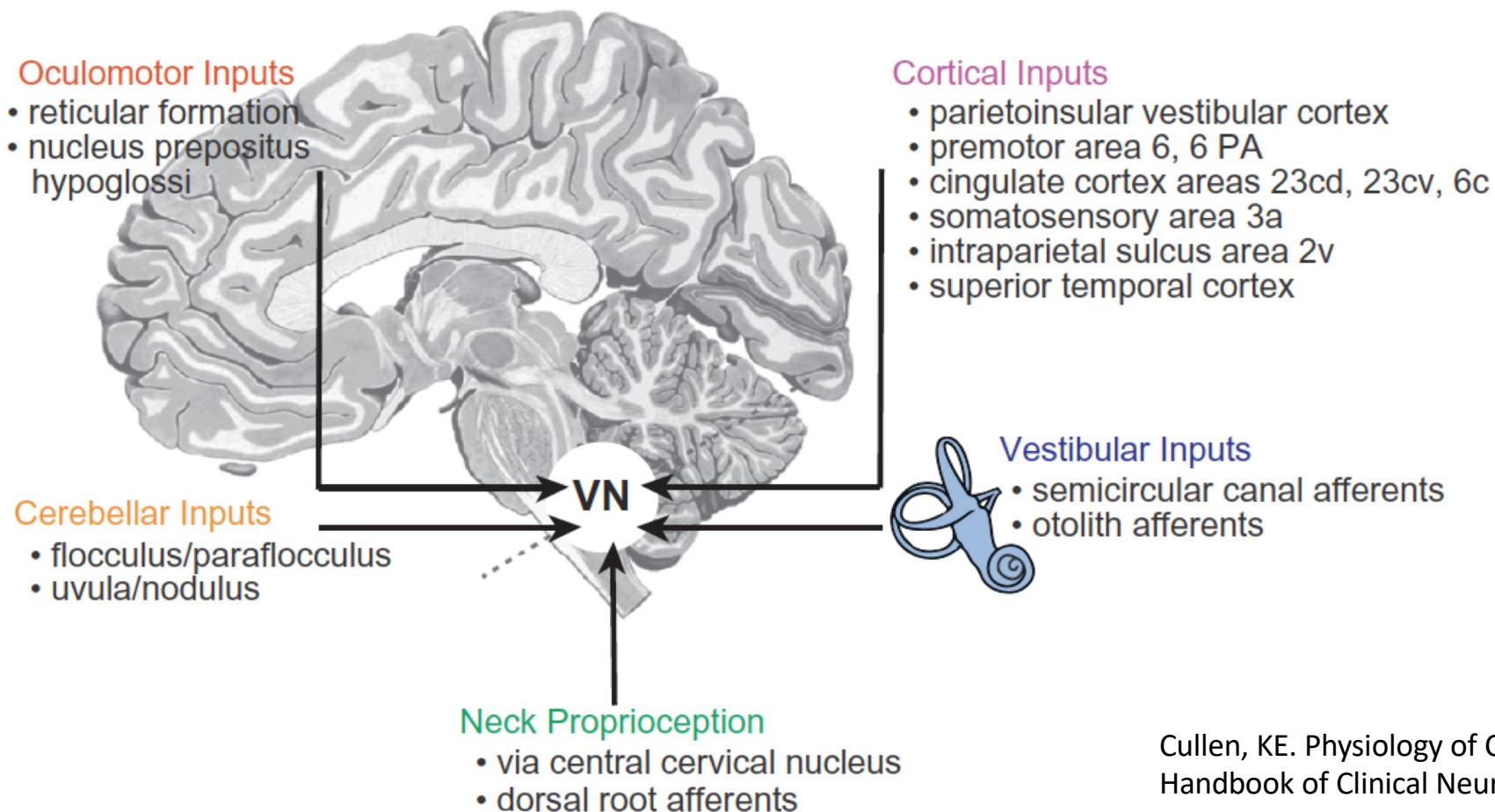
- alterations in the structure and function of the deep cervical flexor and extensor muscles,
- reduced range of neck motion,
- proprioceptive deficits,
- oculomotor disturbances,
- impaired postural control,
- general sensitization of the central nervous system



How do we measure cervical joint dysfunction? – a contemporary approach

- Cranio-Cervical Flexion test
- Cranio-cervical flexion/rotation test
- Joint position error
- Gaze stability test (VOR)
- Smooth pursuit neck torsion test
- Deep cervical flexors and extensors
- Balance
- Pain sensitivity

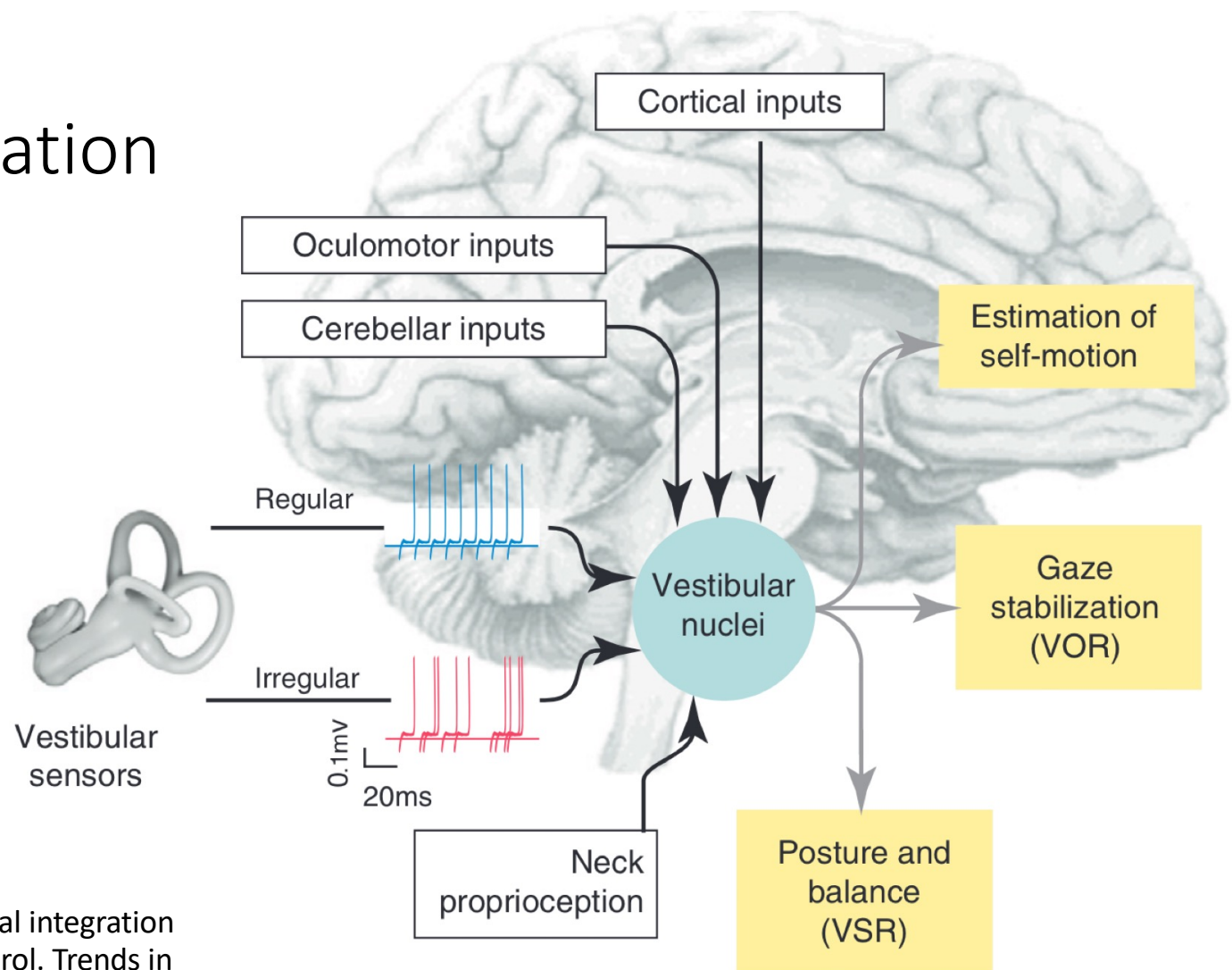
What ties these multisensory signs and symptoms together?



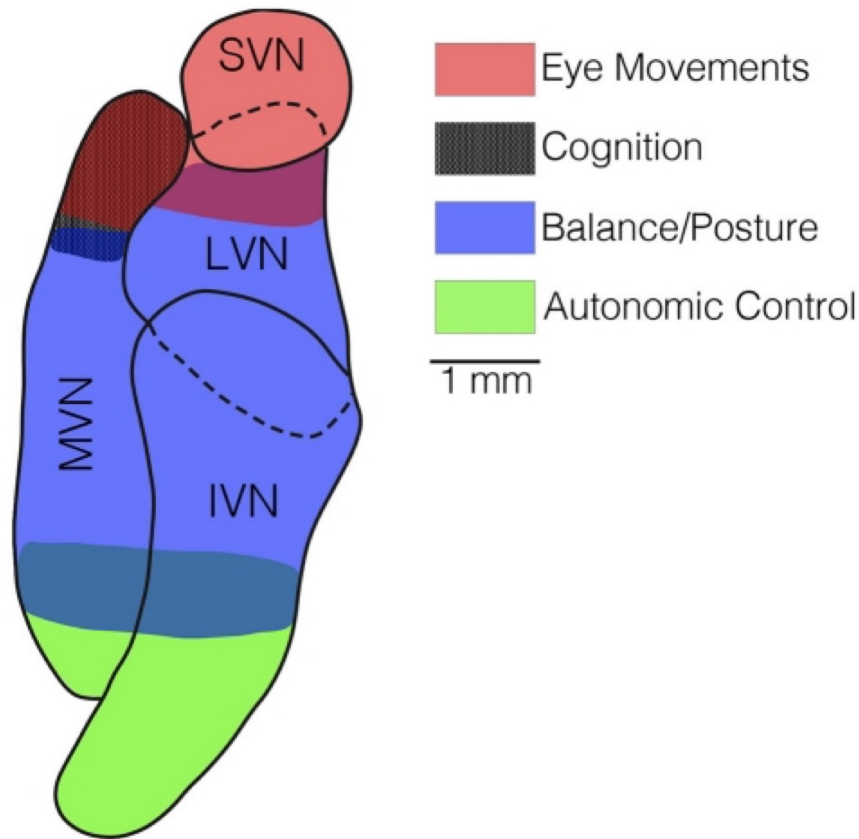
Cullen, KE. Physiology of Central Pathways.
Handbook of Clinical Neurology, Vol. 137, 2017

Multimodal Integration

Somatosensory, proprioceptive, and visual inputs as well as motor-related signals also provide self-motion cues as we interact with the environment



Cullen KE. The vestibular system: multimodal integration and encoding of self-motion for motor control. Trends in Neurosciences. March 2012, Vol. 35, No. 3



Multimodal Integration within the Vestibular Nuclei

A horizontal section through the vestibular nucleus complex showing the locations of the majority of neurons that mediate

- Vestibulo-ocular reflexes (*red shading*)
- Spatial cognition (*black shading*)
- Balance (*blue shading*),
- Autonomic responses (*green shading*).

superior vestibular nucleus (SVN), medial vestibular nucleus (MVN), lateral vestibular nucleus (LVN), inferior vestibular nucleus (IVN)

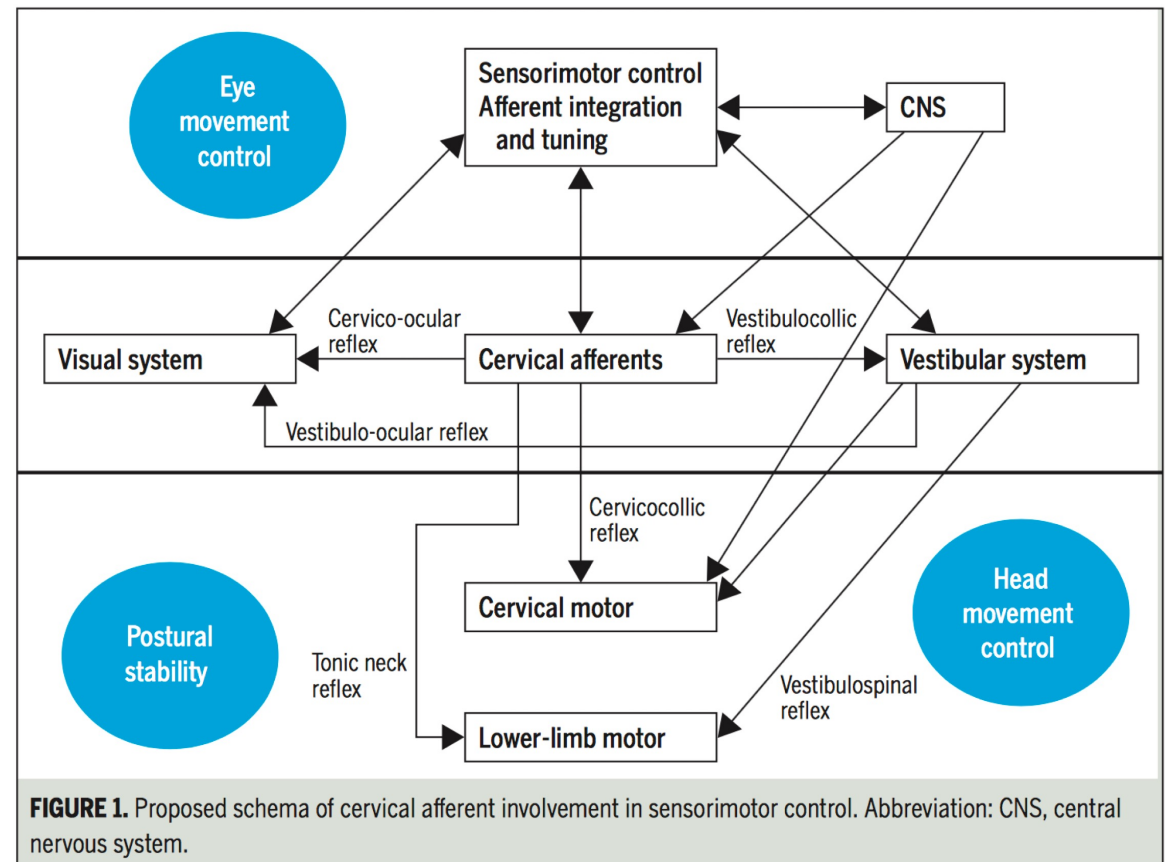
Cervical Spine Connections

VSR - Stabilises body in space

VCR - Stabilises head in space (gravity)

VOR- Stabilises eyes during head movement

CCR- Stabilises head relative to trunk (reticulospinal)



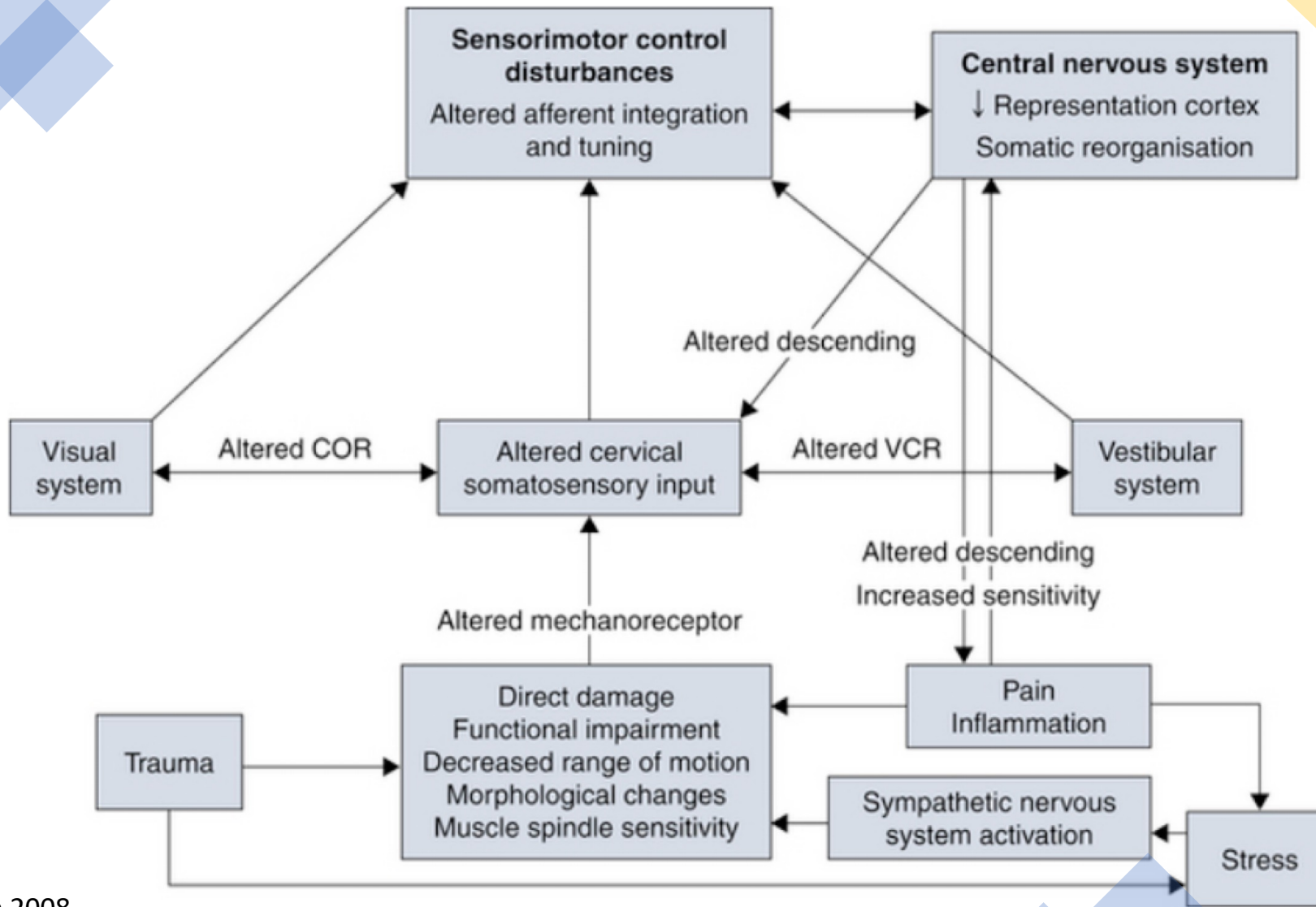
Mechanism of CGD

It's believed to be caused by disruption of the normal cervical proprioceptive afferent input due to cervical dysfunction (e.g., mechanical, degenerative, or inflammatory disorder)

As a result of aberrant proprioceptive signals, patients with CGD have

- dizziness (due to central mismatch with the visual and vestibular systems),
- postural imbalance (due to abnormal cervico-collic and vestibulo-collic reflex activity),
- and are more visually dependent (due to increased reliance on visual information).

De Vestel et al. Clinical characteristics and diagnostic aspects of cervicogenic dizziness in patients with chronic dizziness: A cross-sectional study . *Musculoskeletal Science and Practice* 60 (2022) 102559



How To Assess CGD?

1. Patient History
 - Red flags
 - Cx instability
 - Vestibular
 - Other medical
3. Cx exam and test for CGD





Patient History and Characteristics

A temporal relationship between neck pain or stiffness and the reported dizziness reproduced in the physical examination of the cervical spine

The aggravating behaviour of dizziness in patients was episodic in nature and associated with neck movement and body-position changes.

Jung et al. Clinical Decision Making in the Management of Patients With Cervicogenic Dizziness: A Case Series. J Orthop Sports Phys Ther 2017;47(11):874-884.

Dizziness vs Vertigo

- Vertigo is an illusion of movement; a sensation as if the external world were revolving around the individual (objective vertigo), or as if the individual were revolving in space (subjective vertigo).
- Vertigo is not a symptom arising from the cervical spine, but rather is caused by peripheral vestibular disorders or lesions within the vestibular pathways of the central nervous system.
- Dizziness is the sensation of disturbed or impaired spatial orientation without a false or distorted sense of motion. (unsteadiness, lightheaded, swaying, disequilibrium)

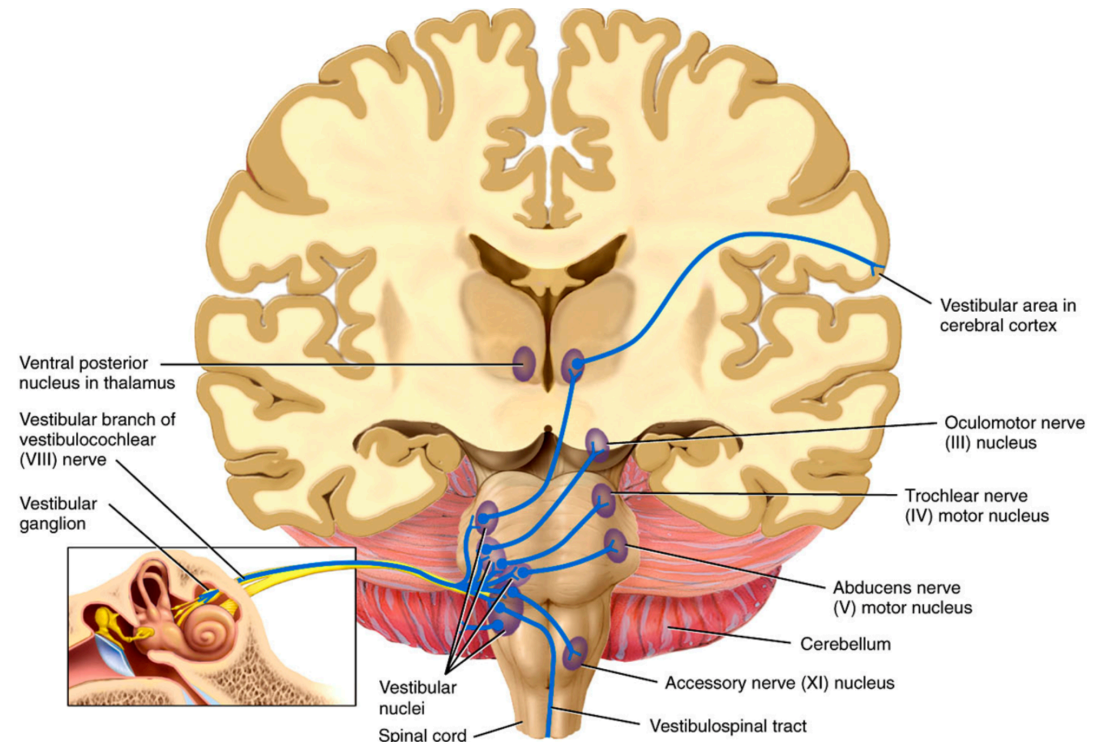


Figure 17.26 Tortora - PAP 12/e
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Bisdorff et al. Overview of the International Classification of Vestibular Disorders. *Neurol Clin* 33 (2015) 541–550

Dizziness vs Vertigo

Kerber, Baloh. The evaluation of a patient with dizziness. *Neurol Clin Pract.* 2011 Dec;1(1):24-33

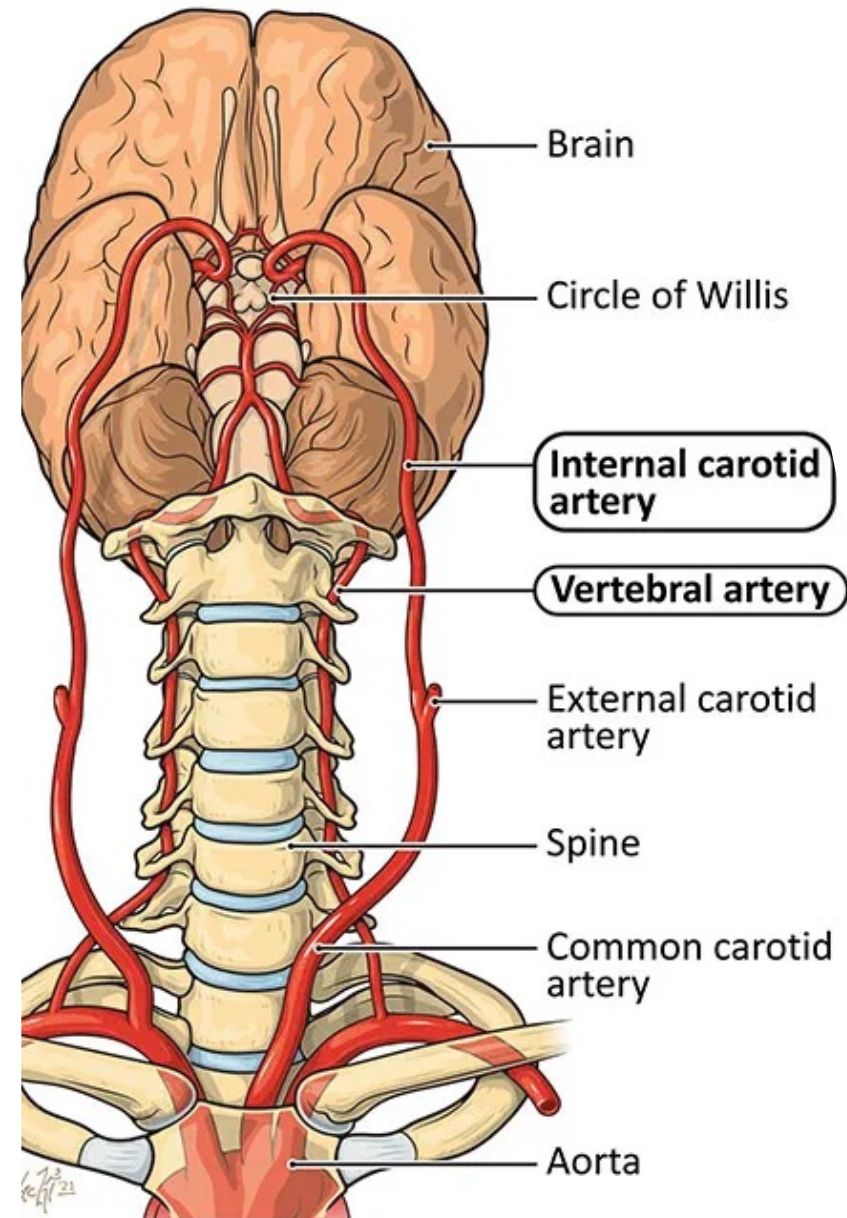
Table 2 Clinical features, diagnosis, and treatment of common causes of dizziness

Disorder	Duration	Triggers	Diagnosis	First-line treatments ^a
BPPV	Seconds	Turning in bed, reaching top shelf	Upbeating-torsional nystagmus on the Dix-Hallpike test	Canalith repositioning maneuver
Vestibular neuritis	Days to weeks	Usually spontaneous	Spontaneous unidirectional horizontal nystagmus, corresponding positive head thrust test	Symptomatic, corticosteroids, physical therapy
Ménière syndrome	Hours	Sodium intake	Fluctuating hearing loss	Restrict salt, diuretic
Migraine-associated dizziness	Minutes-days	Stress, lack of sleep, diet	Personal or family history of migraine headaches; other associated migrainous symptoms	Lifestyle factors, migraine prophylactic medications
Stroke	Days to weeks	Usually spontaneous	Central nystagmus, negative head thrust test, other neurologic signs or symptoms	Stroke management
Posterior circulation TIA	Minutes	Usually spontaneous	Other neurologic symptoms	TIA management
Orthostatic hypotension	Seconds	Standing from sitting or lying	Postural drop in blood pressure	Hydration, reduce offending medications
Vasovagal	Seconds-minutes	Prolonged standing, heat, stress	Positive tilt table test	Hydration
Cardiogenic	Seconds-minutes	Exertion, heart failure	Arrhythmia, valvular disease	Cardiology management
Vestibular paroxysmia	Seconds	Spontaneous multiple spells per day	Associated "clicking" tinnitus, hearing loss	Carbamazepine, oxcarbazepine, gabapentin
Anxiety disorders	Minutes-days	Stress, complex visual surround, crowds	Associated anxiety and other somatic symptoms	Anxiety disorder management
Bilateral vestibulopathy	Chronic	Walking in dark or on uneven surfaces	Bilateral positive head thrust	Vestibular rehabilitation
Cerebellar ataxia	Chronic	Alcohol	Downbeat nystagmus, ataxia, gene test	Symptomatic and supportive care
Motion sickness	Hours-days	Passive head motion	Autonomic symptoms and motion exposure	Meclizine, diphenhydramine, scopolamine
Mal de débarquement	Weeks-months	Ocean voyage, plane trip	Feels better in motion	Benzodiazepines, exercise

Abbreviations: BPPV = benign paroxysmal positional vertigo; SSRI = selective serotonin reuptake inhibitor; TIA = transient ischemic attack.

^a Adequate high-level evidence to support intervention efficacy in the associated disorder is generally lacking. Exceptions to the lack of evidence include the canalith repositioning maneuver for BPPV and the broadly stated management interventions for stroke, TIA, cardiac disorders, and anxiety disorders.

Cervical Arterial Dysfunction (CAD)

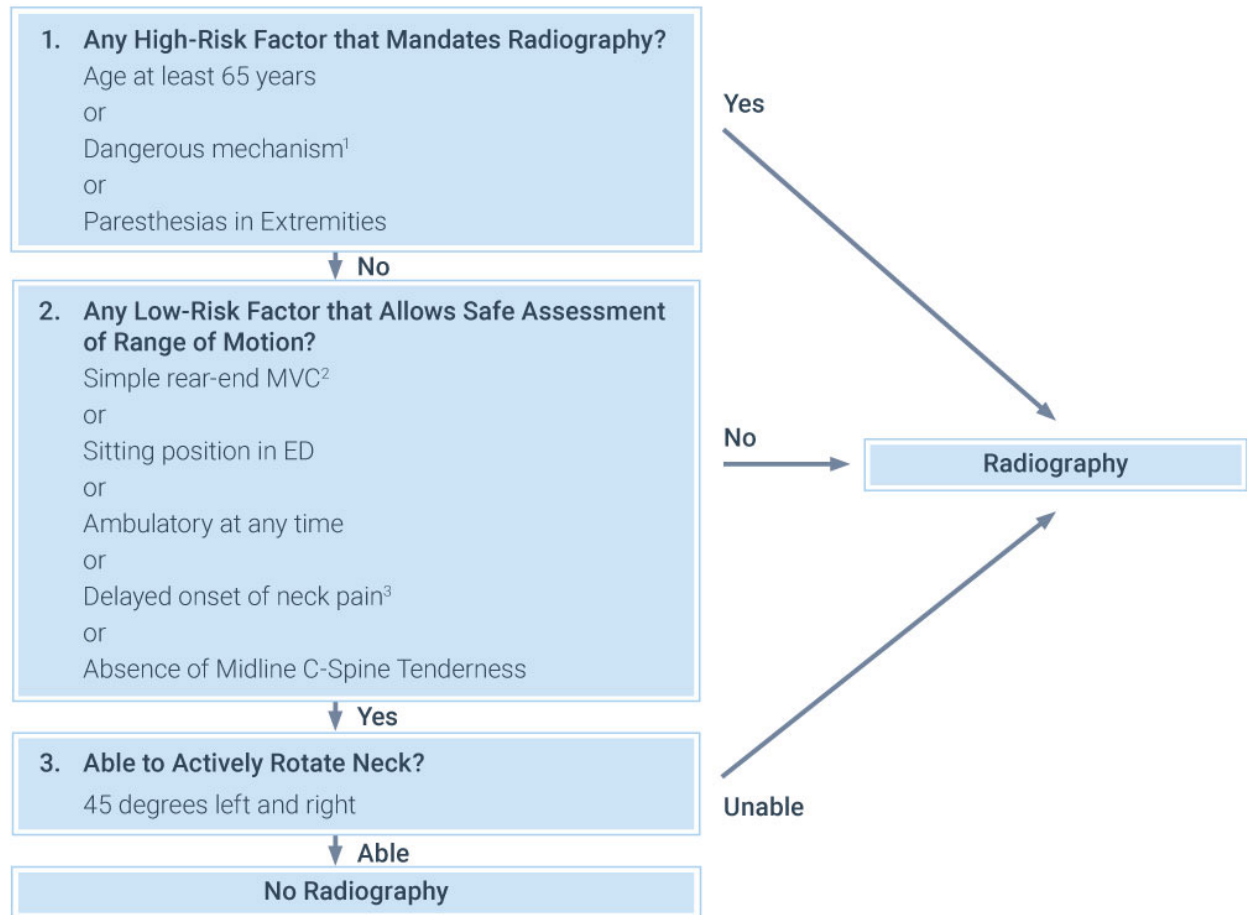


- CAD refers to restricted blood flow in any of the cervical arteries, including the internal carotid arteries, whereas VBI refers only to decreased blood flow in the vertebrobasilar arteries
- There are many potential underlying causes of CAD, including but not limited to atherosclerosis, thrombosis, pre-existing anatomical anomalies, cervical arterial dissection, vasospasm, and external compromise.
- Other symptoms of CAD include severe headache, diplopia, nystagmus, numbness around lips or mouth, dysphagia, dysarthria, and upper motor neuron signs

Cervical Trauma

The Canadian C-Spine Rule

For Alert (Glasgow Coma Scale Score = 15) and Stable Trauma Patients Where Cervical Spine (C-Spine) Injury is a Concern



MVC = Motor vehicle collision; ED = emergency department

Dangerous Mechanism

- Fall from at least 1 meter or 5 stairs
- Axial load to head, e.g., diving
- MVC high speed (over 100km.hr), rollover, ejection
- Motorized recreational vehicles
- Bicycle collision

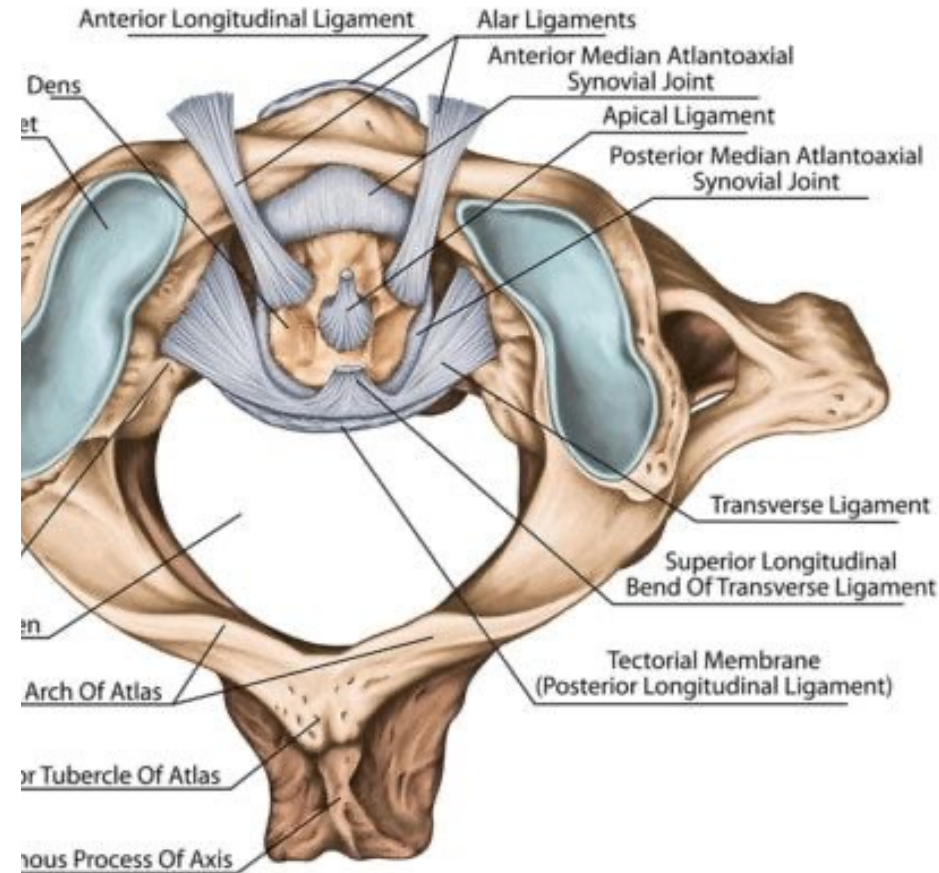
Simple Rear-end MVC Excludes

- Pushed into oncoming traffic
- Hit by bus/large truck
- Rollover
- Hit by high-speed vehicle

Delayed

- Not immediate onset of neck pain

Upper Cervical Spine Instability



Alar Ligament Test

- If the alar ligaments are intact, lateral flexion or rotation of the head should result in palpable contralateral movement of the C2 spinous process.

Sharp Purser Test

- This test assesses the integrity of the transverse ligament that maintains the position of the odontoid process relative to C1. If the transverse ligament is torn, C1 will translate forward on C2 during flexion, indicating atlantoaxial subluxation.

Vestibular Assessment

- The Cx spine is examined prior (ROM, pain provocation) to the vestibular system.
- The vestibular exam can be modified to limit the head movements to the available cervical ROM
- Which test to perform will be guided by the differential diagnosis obtained from the patient's history of dizziness/vertigo characteristics

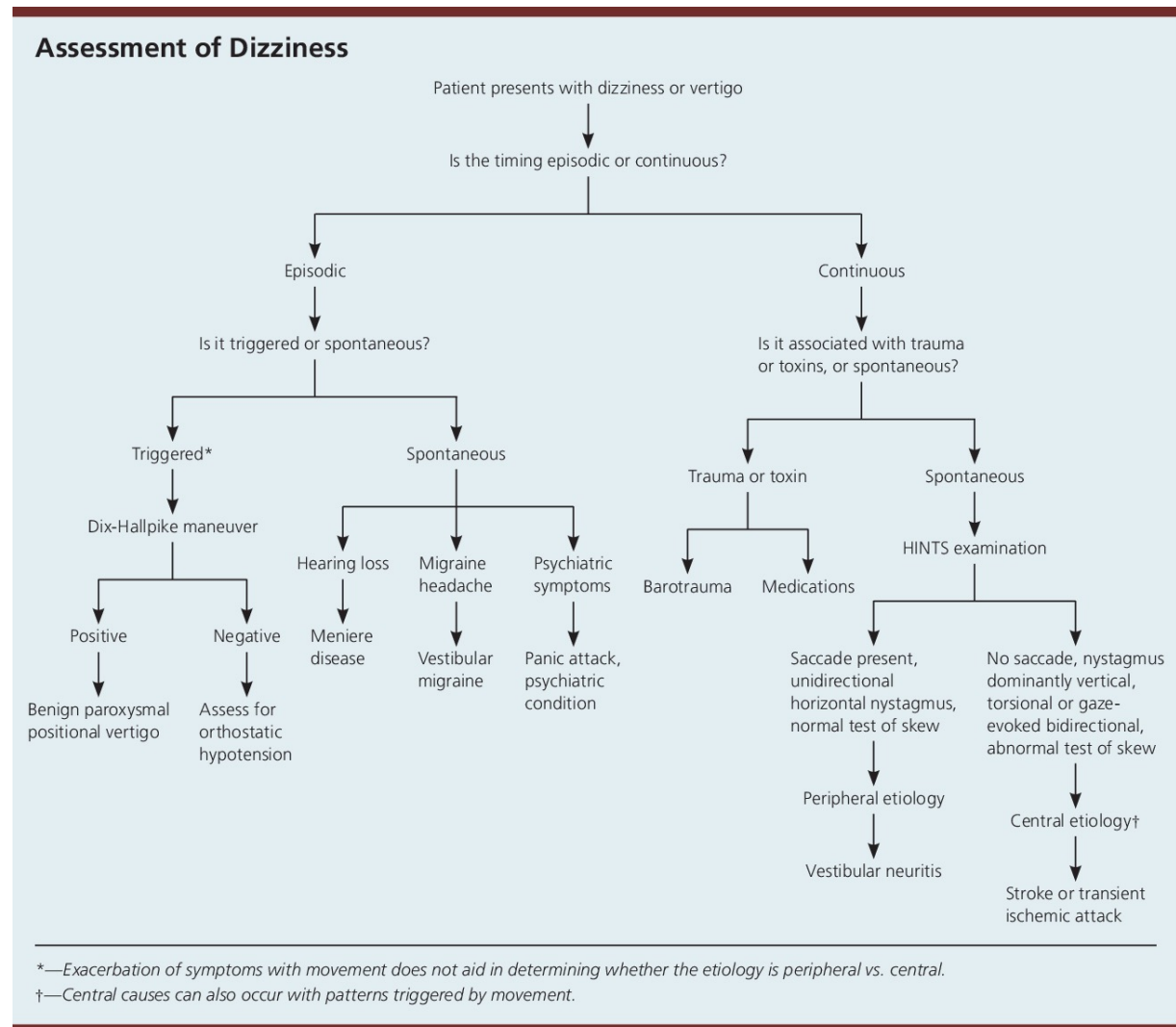
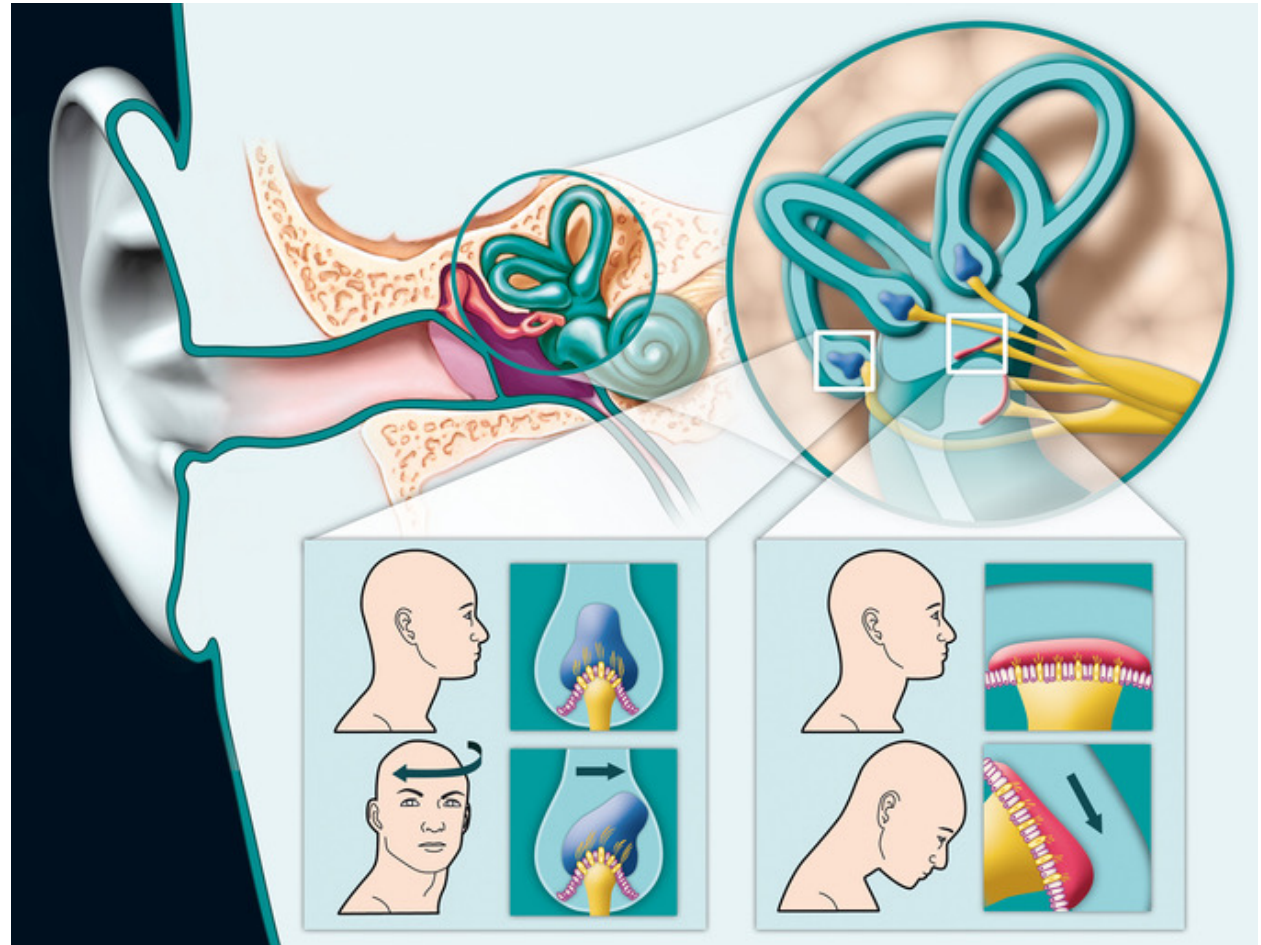


Figure 1. Algorithm for the diagnostic evaluation of dizziness. (HINTS = head-impulse, nystagmus, test of skew.)

Vestibular Organ

The inner ear (semi-circular canals and otolithic organs) sense movement (translational and linear) and gravity

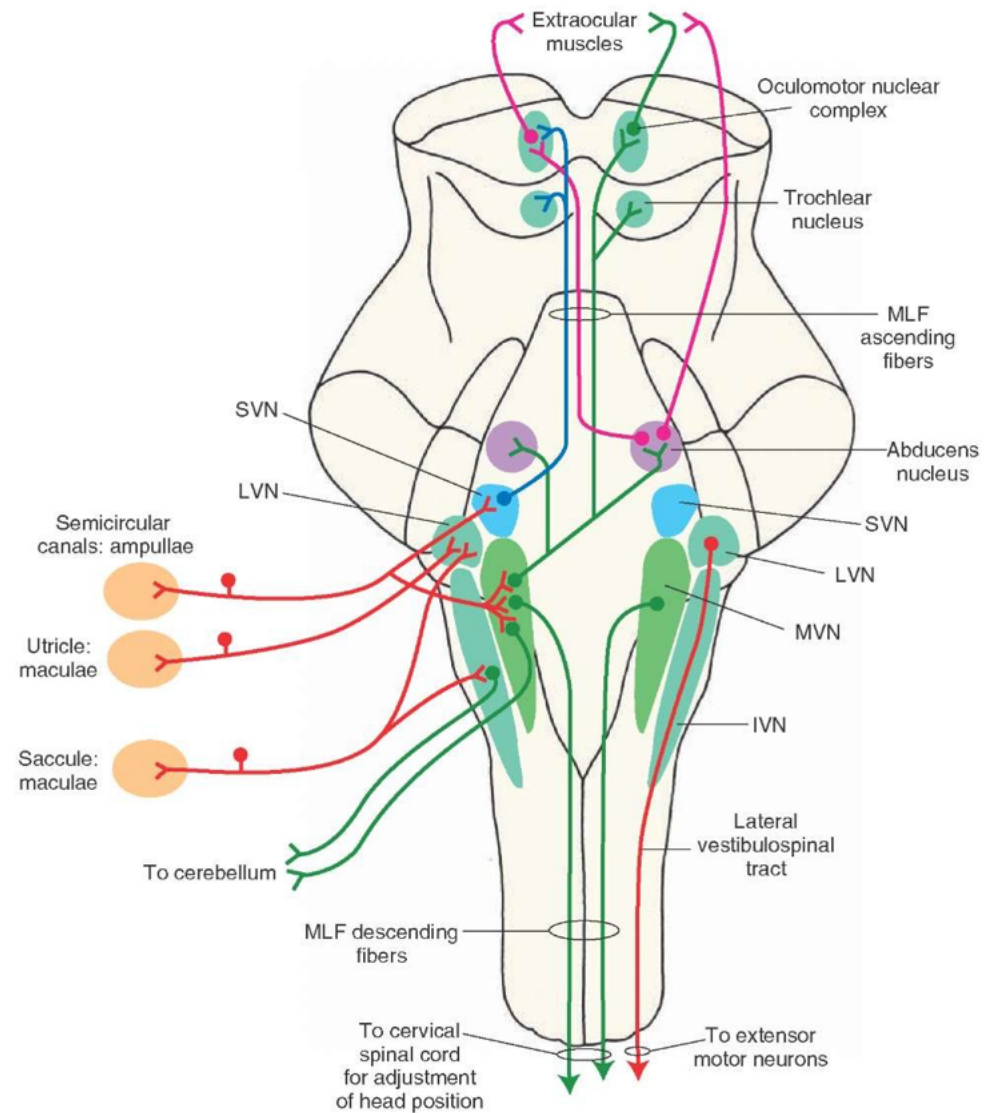


Vestibular Connections

Vestibular information coded by CN8, then synapses with Vestibular Nuclei in brainstem.

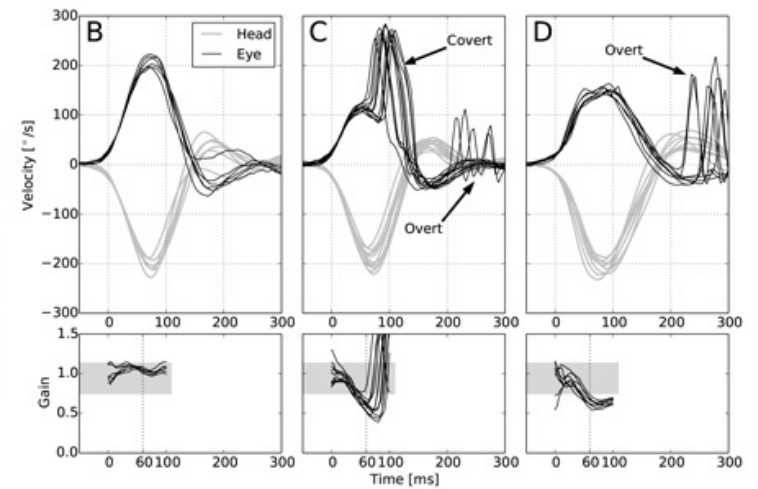
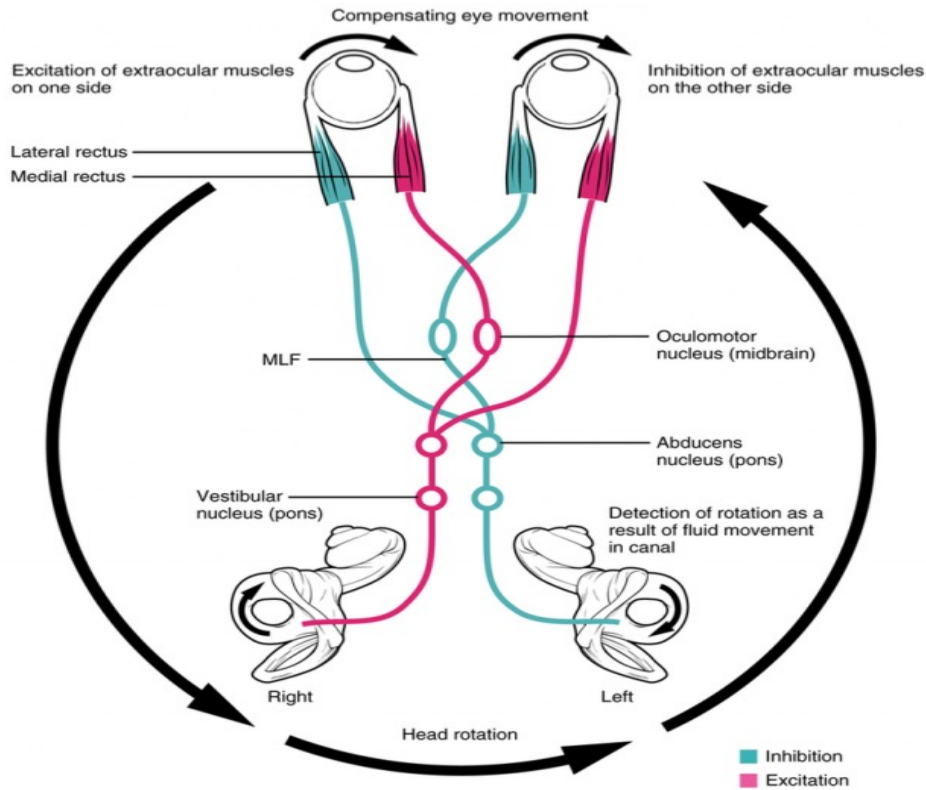
This then passes to

- CN 3,4 and 6 for eye movement
- Vestibulospinal pathways to control postural muscle tone
- Cerebellum for sensory motor adaptation



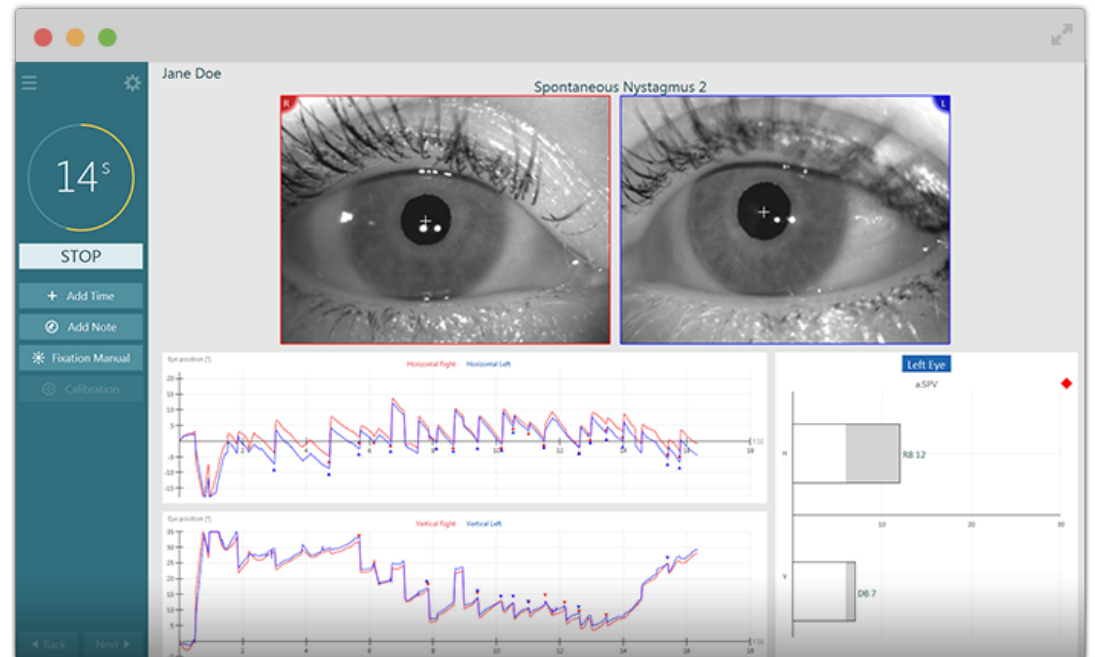
Vestibular Assessment

Vestibular-Ocular Reflex (VOR)



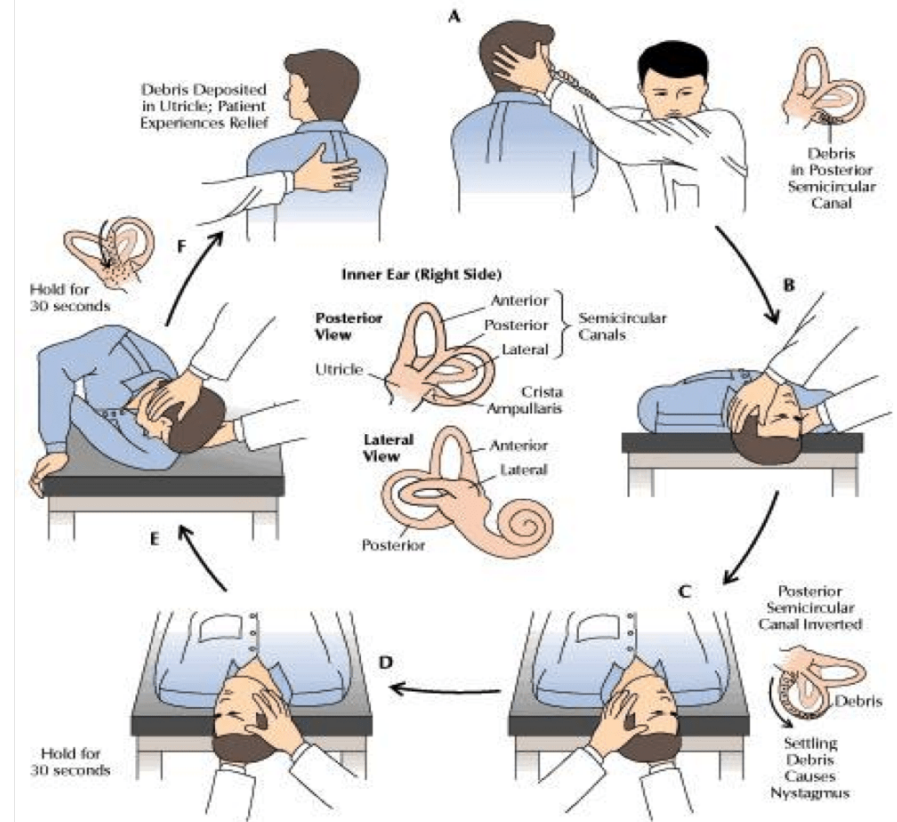
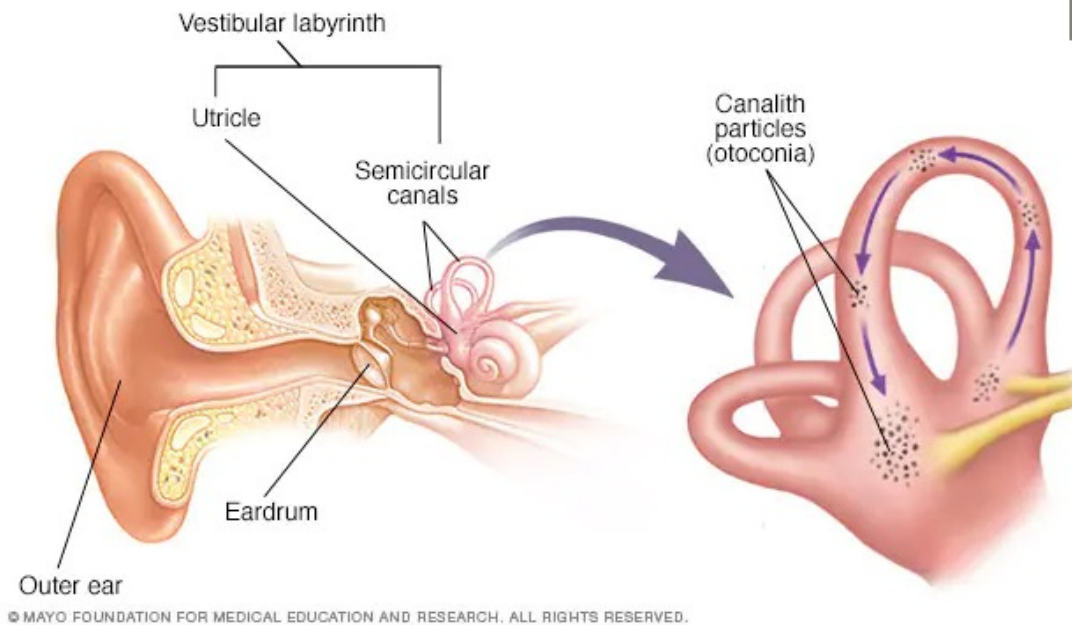
Vestibular Assessment

Nystagmus



Vestibular Assessment

BPPV (benign paroxysmal positional vertigo)



Cx Spine Assessment

Manual

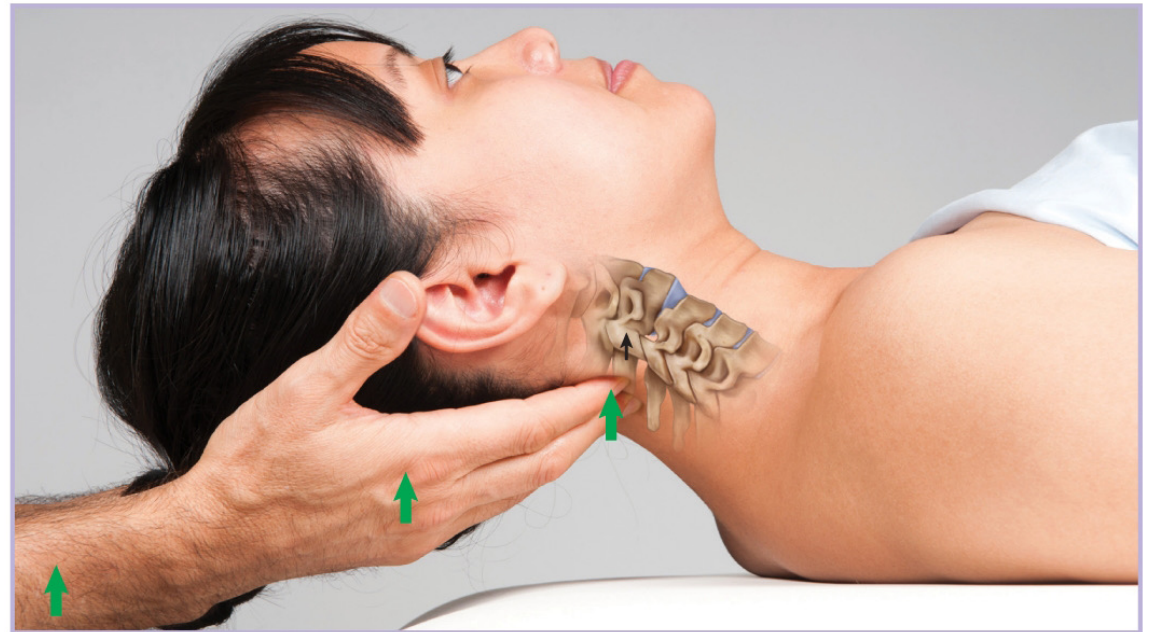
Manual Spinal Examination for facet joint dysfunction

- P-A glide for pain provocation and resistance

(92% sensitivity, 71% sensitivity)

Palpation for Segmental Tenderness

(94% sensitivity, 73% sensitivity)



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Sensorimotor Function and Dizziness in Neck Pain: Implications for Assessment and Management

CGD Assessment

Disturbed

- proprioception (head-neck awareness)
- neck movement control
- neck range of motion
- oculomotor function
- balance
- postural stability
- co-ordination of head, spine and limbs

Persistent neck pain of greater than 6 months' duration is a frequent occurrence in both men and women,⁴¹ and patients with neck pain are the second largest group (after patients with low back pain) attending physical therapy and chiropractic clinics for relief of their symptoms.² Further research shows that about one third of patients diagnosed with whiplash-associated disorder (WAD) (a variety of clinical manifestations due to bony or

soft tissue neck injuries following an acceleration-deceleration energy transfer sustained from a motor vehicle accident¹²⁰) only gain short-term relief by conventional musculoskeletal interventions,^{12,82,123} which, by definition, are



an ineffective treatment. Preventing a portion of patients with neck pain to enter the chronic phase of their condition represents a great challenge for clinicians.

The cervical spine, especially the upper cervical spine, is the most

mobile part of the vertebral column. Its mobility comes at the expense of its mechanical stability.^{7,22} The highly developed proprioceptive system provides neuromuscular control to the mobile cervical spine and allows efficient utilization of the vital organs in the head⁴³ via unique connections to the vestibular and visual systems.^{22,77,80,87,105} This may explain why the cervical spine is an extremely vulnerable structure, especially where trauma is involved (eg, whiplash injury), and is a source of a plethora of symptoms that do not arise from any other musculoskeletal region of the body.⁵⁸

Disturbances to the afferent input from the cervical region in those with neck pain may be a possible cause of symptoms such as dizziness, unsteadiness, and visual disturbances, as well as signs of altered postural stability, cervical proprioception, and head and eye movement control. Conventional approaches to management may be sufficient for patients with neck pain with minimal sensorimotor proprioceptive disturbances. However, clinical experience and research indicates that significant sensorimotor proprioceptive disturbances in the cervical spine might be an important factor in the maintenance, recurrence, or progression of various symptoms in patients with neck pain.^{59,122} Thus, addressing these deficits is likely to be an important step

• **SYNOPSIS:** The term sensorimotor describes all the afferent, efferent, and central integration and processing components involved in maintaining stability in the postural control system through intrinsic motor-control properties. The scope of this paper is to highlight the sensorimotor deficits that can arise from altered cervical afferent input. From a clinical orthopaedic perspective, the peripheral mechanoreceptors are the most important in functional joint stability; but in the cervical region they are also important for postural stability, as well as head and eye movement control. Consequently, conventional musculoskeletal intervention approaches may be sufficient only for patients with neck pain and minimal sensorimotor proprioceptive disturbances. Clinical experience and research indicates that significant sensorimotor cervical proprioceptive disturbances

might be an important factor in the maintenance, recurrence, or progression of various symptoms in some patients with neck pain. In these cases, more specific and novel treatment methods are needed which progressively address neck position and movement sense, as well as cervicogenic oculomotor disturbances, postural stability, and cervicogenic dizziness. In this commentary we review the most relevant theoretical and practical knowledge on this matter and implications for clinical assessment and management, and we propose future directions for research.

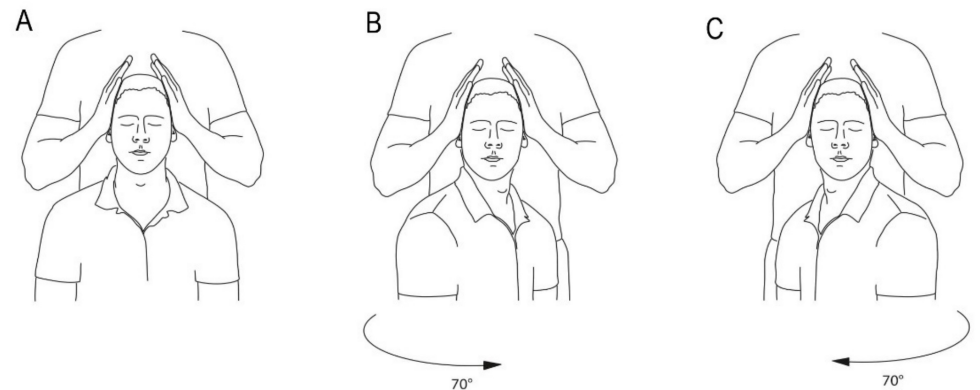
• **LEVEL OF EVIDENCE:** Level 5. *J Orthop Sports Phys Ther* 2009;39(5):364-377. doi:10.2519/jospt.2009.2834

• **KEY WORDS:** cervical, head, postural stability, proprioception, sensorimotor

CGD Assessment

Cervical Neck Torsion Test (Fitz-Fitson)

The patient begins seated on a swivel chair and turns their trunk maximally (up to) 90° to the either the right or left, holding for 30 s, then returns their trunk to centre. The patient then repeats the same process in the opposite direction. Each position, including the centre positions, is maintained for 30 s. Throughout the test, the head is stabilized by the clinician and therefore motionless. The clinician also must continuously observe for nystagmus and symptoms



CGD Assessment

Cervical Neck Torsion Test (Fitz Fitson)



99% specificity

Treleven 2022

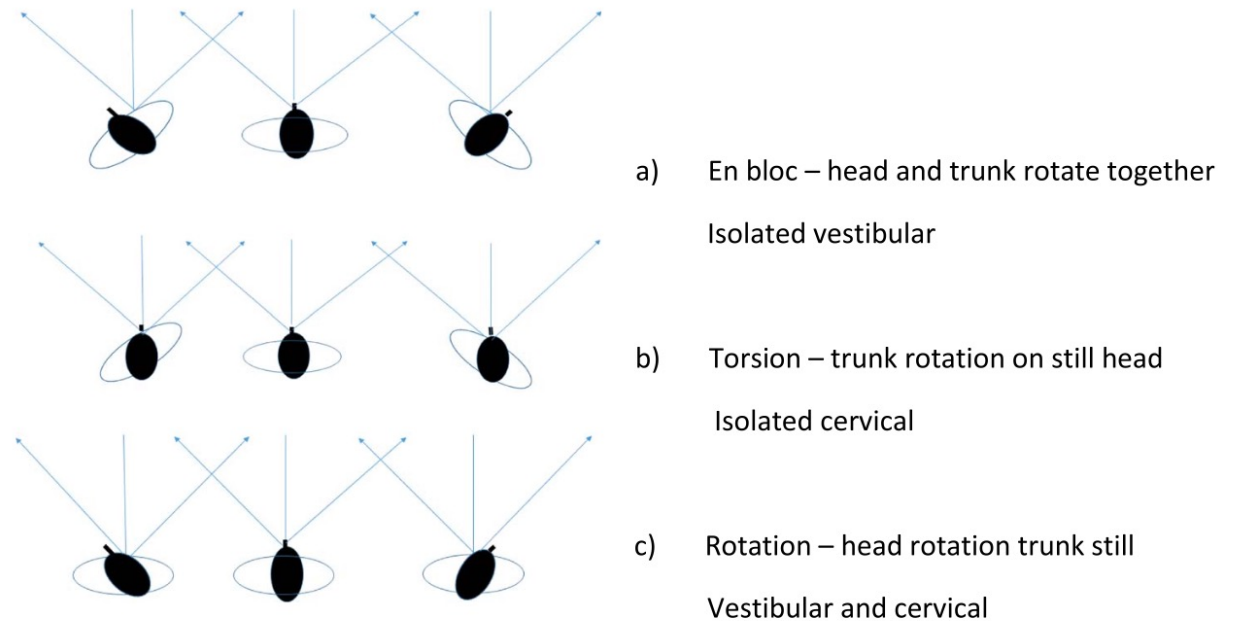
<https://www.physiotutors.com>

CGD Assessment

Head-Neck Differentiating test

It is similar to the CTT, albeit performed using fast movement oscillations rather than sustained positions.

Clinical cervical torsion test procedures. (a) En bloc component (head and trunk rotation together). (b) Torsion component. (c) Rotation component. Trunk, head, or both move at least 45°–90° degrees to left and right.



CGD Assessment

Head-Neck Differentiating test



90% specificity

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<https://www.physiotutors.com>

CGD Assessment

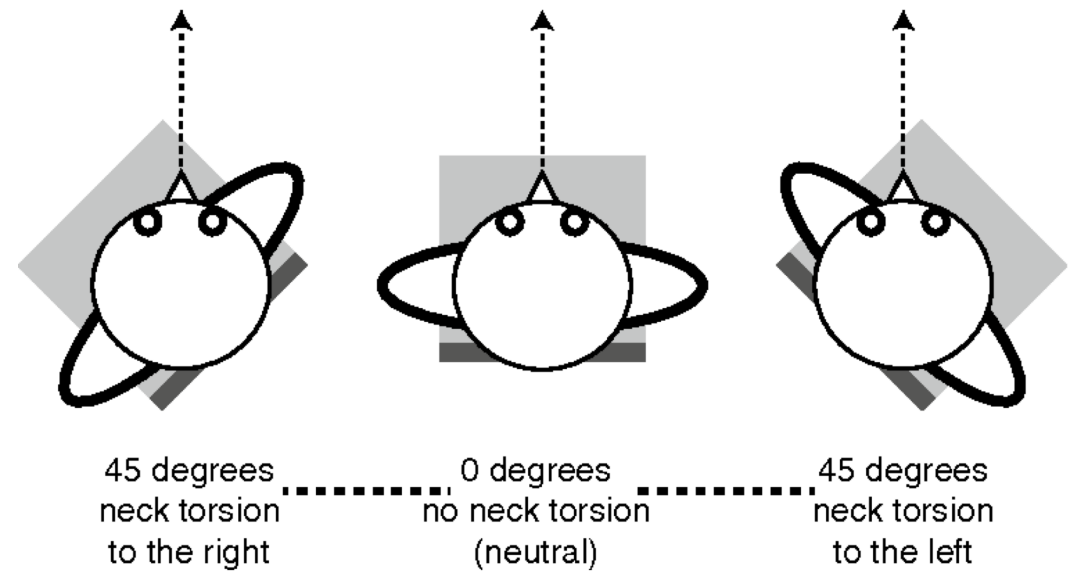
Smooth Pursuit Rotation Test

Comparison between smooth pursuit with head neutral vs head rotated, looking for

- eye movement
- Symptoms

Start with a neutral head position

Then perform same test with the trunk rotated 45° (head remains straight)



CGD Assessment

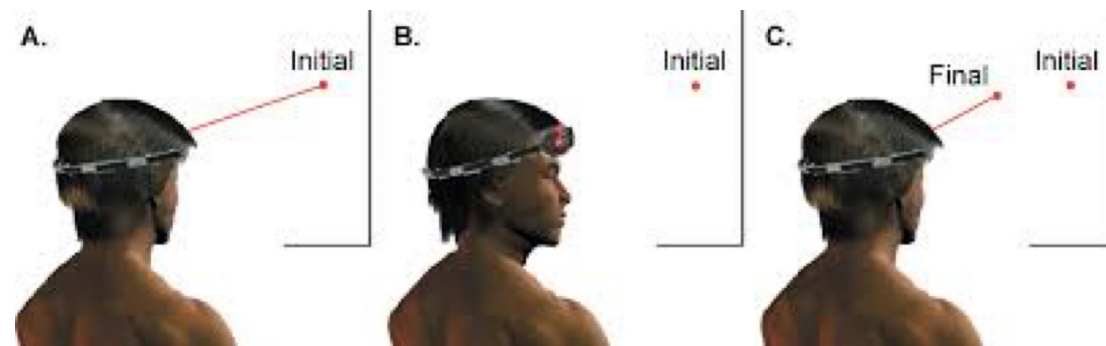
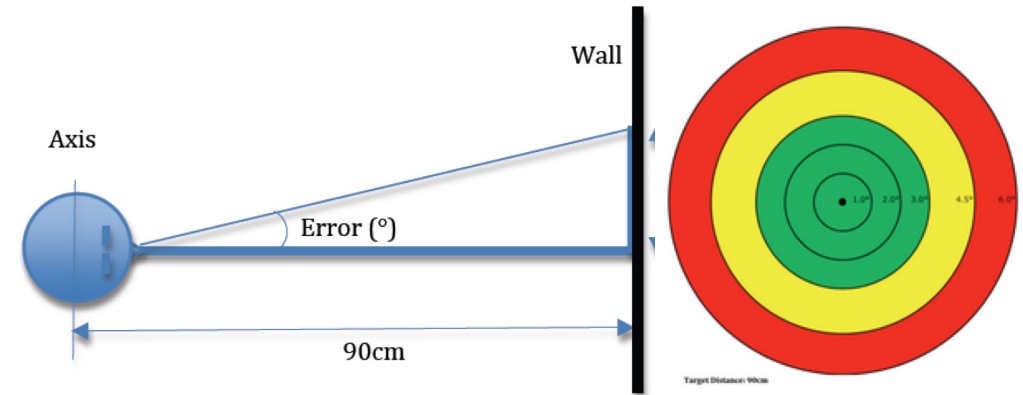
Smoot Pursuit Rotation Test



CGD Assessment

Cervical Relocation Test

The patient begins seated, facing a wall 90 cm away, and wearing a head-mounted laser pointer that is centred on a target on the wall. The patient keeps their eyes closed while moving their neck in a specified direction, then back to what they believe to be centred starting position. The patient verbally indicates when they believe they are back to centre. The patient repeats this process for right rotation, left rotation, flexion, and extension (in no particular order).



CGD Assessment

Cervical Relocation Test

The mean distance from the actual centre to the subjective centre is used to calculate the joint position error (JPE) for each movement. An error of 4.5° is the cut-off point suggesting a failure of head and neck relocalisation precision.

$< 4.5^\circ$ – normal proprioception

$> 4.5^\circ$ – abnormal proprioception



CGD Assessment

Cervical Flexion Rotation Test

The cervical flexion-rotation test is an objective method of determining upper cervical joint (C0-2) dysfunction.

The cervical spine is fully flexed, in an attempt to isolate movement to C1-C2, which has a unique ability to rotate in flexion, ruling out movement from other levels

Range of rotation in end-range flexion is normally 40–44° to each side. Dysfunction approx 20°
high sensitivity (91%) and specificity (90%) in differentiating subjects with CGH from asymptomatic controls or subjects with migraine with aura..



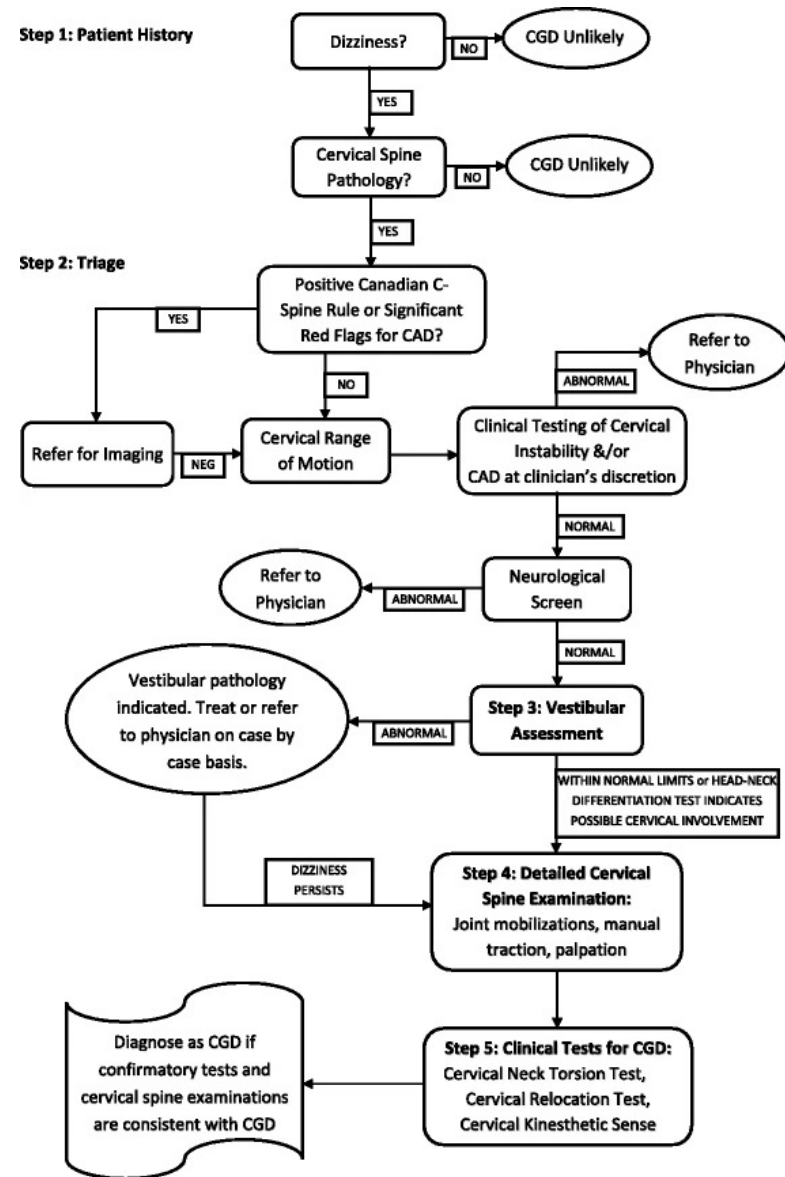
Ogince et al. The diagnostic validity of the cervical flexion-rotation test in C1/2 related cervicogenic headache. *Man Ther* 2007;12:256-262

CGD Assessment

Cervical Flexion Rotation Test



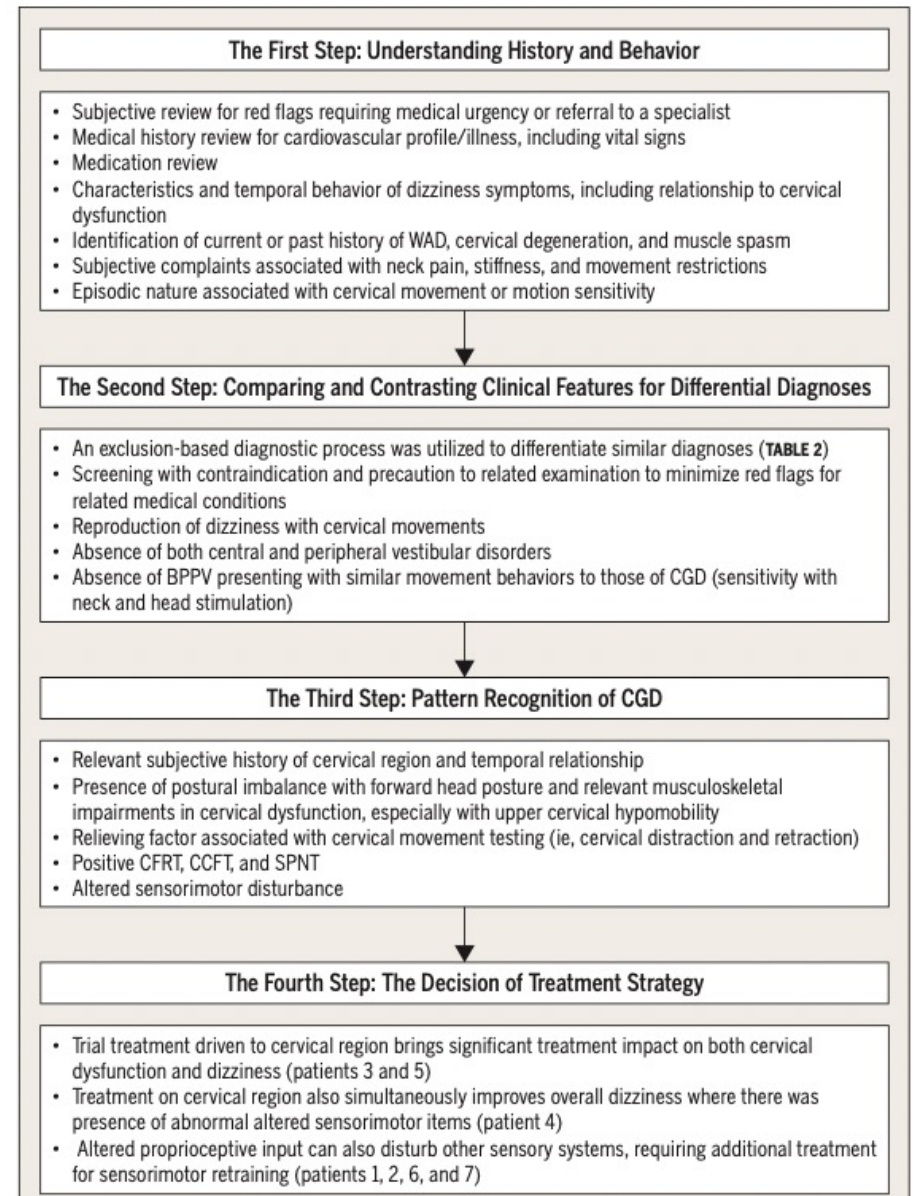
Decision Making Summary



Decision Making Summary

The flow of the clinical decision-making approach. Abbreviations: BPPV, benign paroxysmal positional vertigo; CCFT, craniocervical flexion test; CFRT, cervical flexion rotation test; CGD, cervicogenic dizziness; SPNT, smooth pursuit neck torsional test; WAD, whiplash-associated disorder.

Jung et al 2022



Individualized Sensorimotor Program

Management of disturbed sensorimotor dysfunction needs to address the local causes of abnormal afferent (feedback) input.

Physical therapy interventions such as pain management, manipulative therapy, active range-of-motion exercises, and exercises to improve neuromuscular control will all be important in reducing possible causes of altered afferent cervical input and subsequent disturbances to sensorimotor control.

Sensorimotor Function and Dizziness in Neck Pain: Implications for Assessment and Management

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Case Report

A tailored sensorimotor approach for management of whiplash associated disorders. A single case study

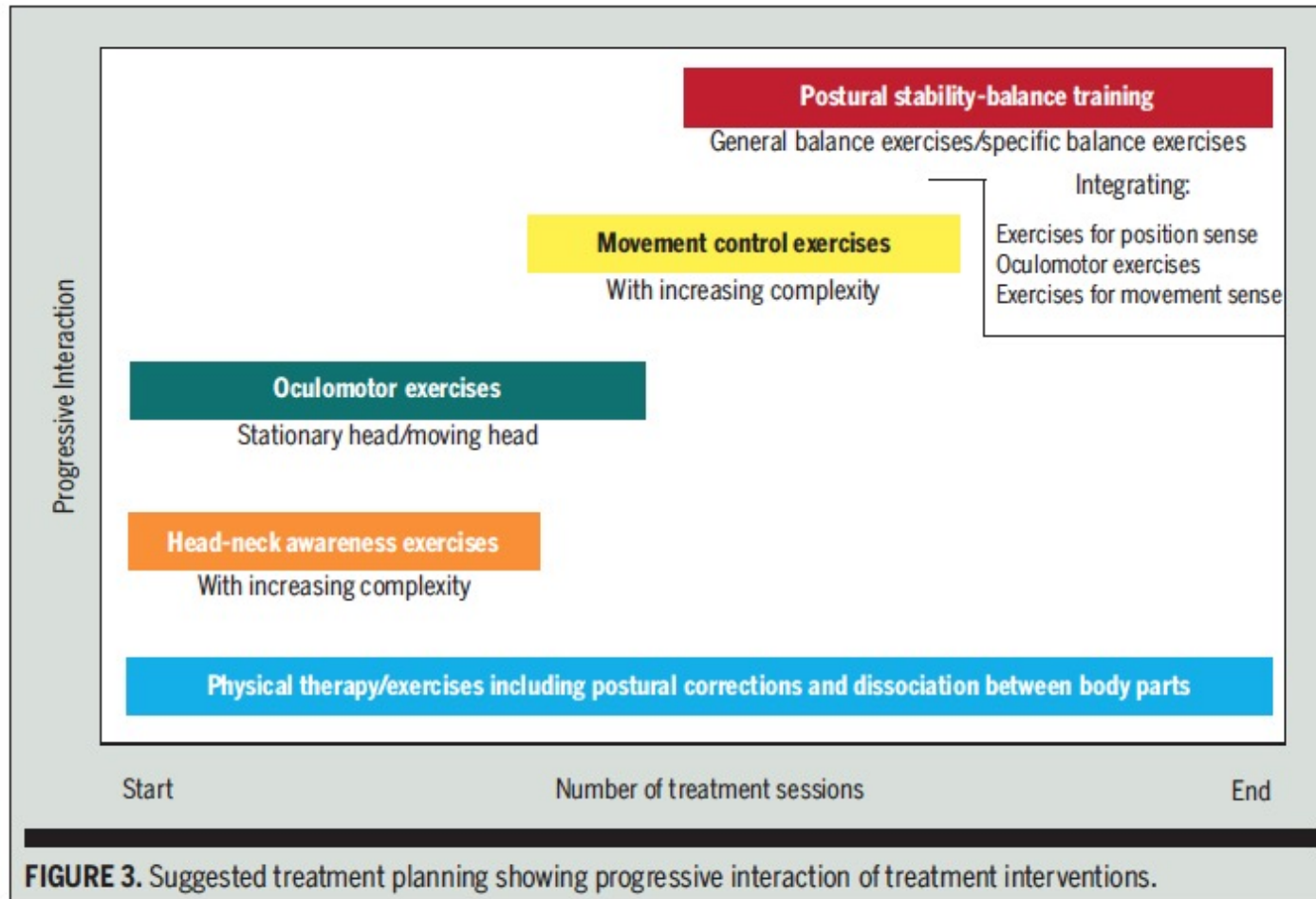
Julia Treleaven*

Individualized Sensorimotor Program



For best results, the tailored rehabilitation program needs to include

1. Addressing altered cervical sensorimotor function
 - SMT, acupuncture, JPE retraining, cervical motor control (neuromuscular) exercises
2. Vestibular and Visual
 - eye-neck co-ordination exercises, gaze stabilization, VRT, oculomotor exercises (pursuit, saccades, OPK)
3. Balance and Posture Stability
 - ball, air disc, bosu, foam pads, tandem, eyes open/closed



EYTHOR KRISTJANSSON, PhD, ManipTher, BSc¹ • JULIA TRELEAVEN, PhD, BPhy²

CGD Treatment

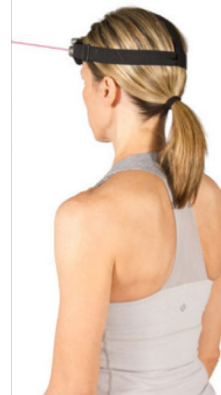
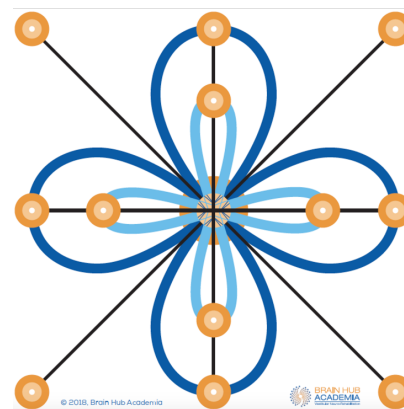
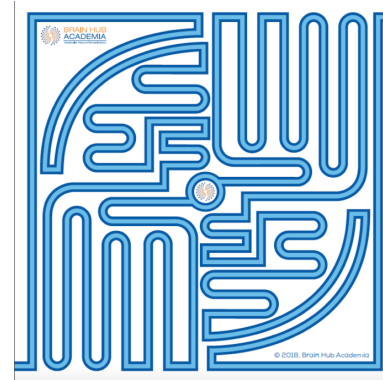
Joint Position Error Retraining

Practice relocating head from previously determined abnormal direction(s)

- Eyes open
- Eyes closed
- Different perturbed surfaces
- Cognitive tasking

Can add movements

- Out to in
- In to out
- Random targets



CGD Treatment

Deep Neck Flexor

Goal is to improve the activation and control of the deep cervical flexors when performing a craniocervical flexion movement

- depending on assessment competency, perform 10sec holds at 20mmHg with rest periods in between
- Increase by 2mmHg each time

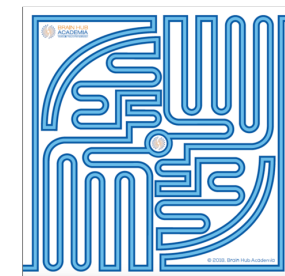
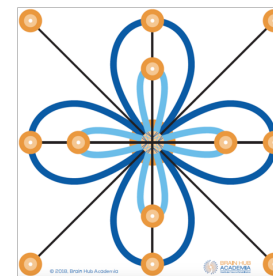
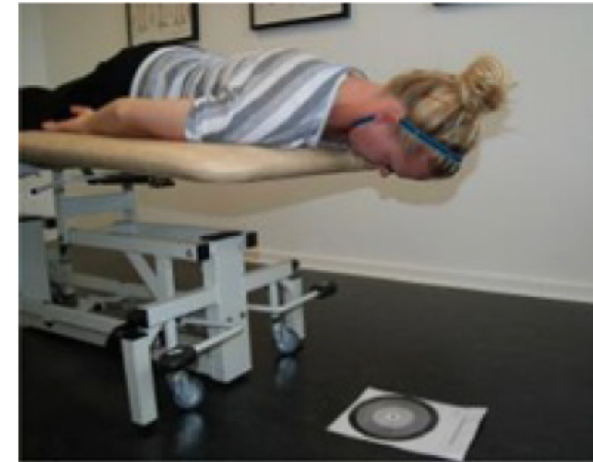


Jull et al. Clinical assessment of the deep cervical flexor muscles: the craniocervical flexion test. *J Manipulative Physiol Ther.* 2008;31:525-533

CGD Treatment

Cervical Extensor

- Prone, legs straight, arms by side.
- Laser light attached to the head, aimed at a target on the floor (60 cm distant). Subject performs low cervical extension with the cranio-cervical region maintained in a neutral position (light on target).
- Hold for 0-120secs whilst maintaining position of laser
- Add JPS retraining
- Add spinal extensor and scapular stabilisation exercisers



CGD Treatment

Head-Neck Dissociation

Swivel chair

- Head laser on centre target
- Actively swivel on chair keeping the laser centred
- Passively swivel on chair keeping the laser centred
- Progress with greater speed and distance of rotation

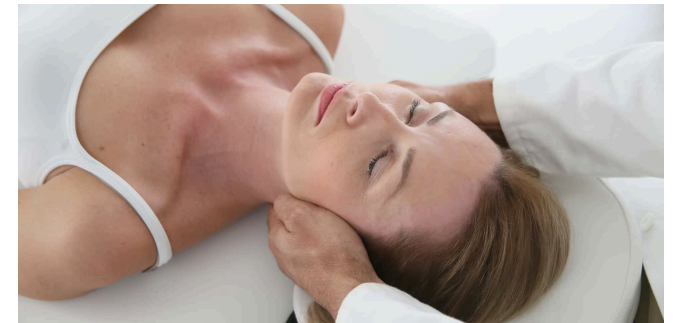


CGD Treatment

Spinal Adjustments (SMT)

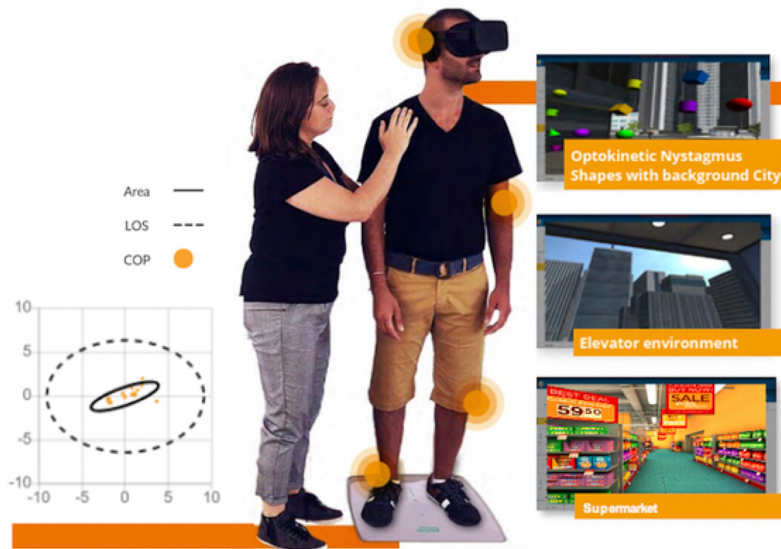
Manual therapy (both mobilization and manipulation techniques) targeting the upper cervical spine has been shown to not only reduce muscle spasms and restore zygapophyseal joint mobility and joint play, but also to promote the flow of afferent information, including proprioceptive input, toward the central nervous system

This systematic review has found that there is moderate (Level 2) evidence in a favourable direction to support the use of manual therapy (spinal mobilisation and/or manipulation) for cervicogenic dizziness.



Lystad et al. Manual therapy with and without vestibular rehabilitation for cervicogenic dizziness: a systematic review. *Chiropractic & Manual Therapies* 2011, 19:21

Virtual Reality



Jared *et al* 2018, Santos *et al* 2020, Lambert *et al* 2017



Love your brain

Thank you

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BRAIN HUB
Dizziness & Concussion Clinic