The Cervical Spine Clinical Trajectory

Presenter: Mark Boland, PT, DPT, OCS, MBA
Director of Physical Therapy
DiSepio Institute for Rural Health and Wellness

ImPACT® APPLICATIONS, INC.

Disclosure Statements

- The statements and opinions contained in this program are solely those of the presenter.
- Treatment options and tools presented are some of many that are available.
- All individuals in control of content disclosed no relevant financial relationships.
- Other CE disclosures can be found in your course information document.

Course Description

Learn assessment and rehabilitation techniques for the cervical spine post-concussion. You will learn how and when to initiate treatment for cervical spine involvement and tools and assessments that a PT can use to examine neck pain.

Course Objectives: At the end of the course, attendees should be able to:

- Review use of available assessment tools and results that may indicate cervical spine involvement.
- List useful tests during a clinical exam and their relation to concussion.
- Identify basic intervention strategies for the cervical spine and how and when to initiate treatment.

Speaker Biography

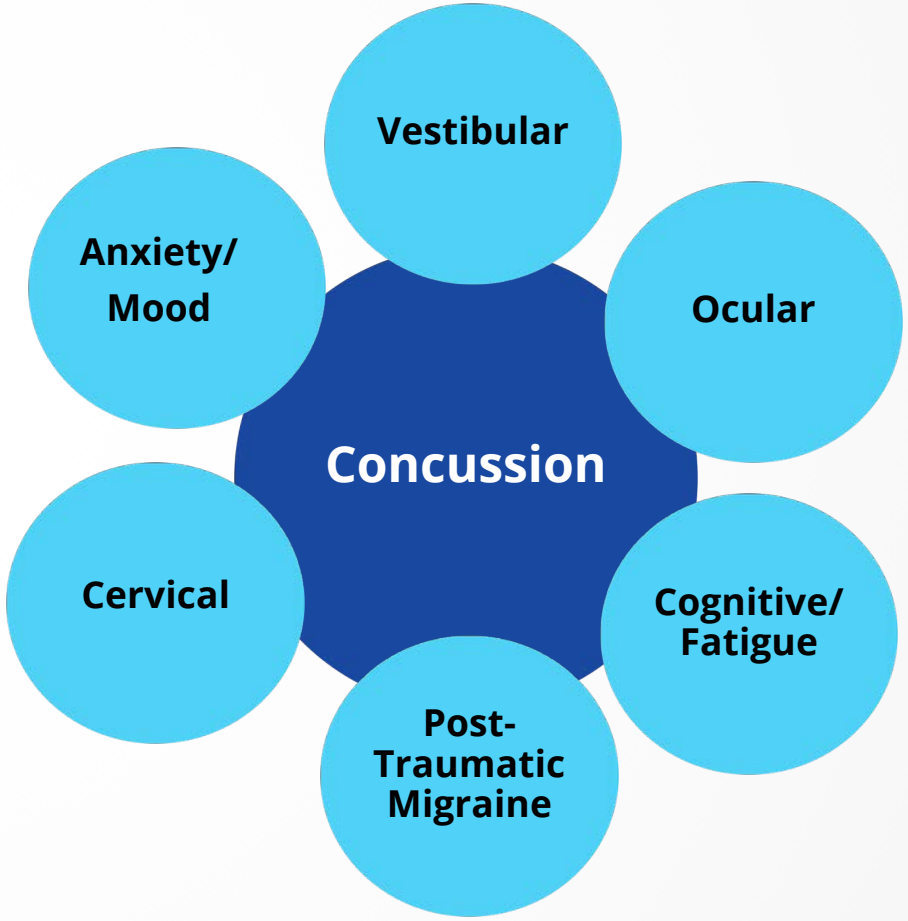
Mark Boland, PT, DPT, OCS

Director of Physical Therapy
DiSepio Institute for Rural Health and Wellness

- Became Board Certified as an Orthopaedic Clinical Specialist in 2009
- Earned DPT from Temple University in 2013
- Serves as the Director of the DiSepio Center for Rehabilitation, which is housed on campus in the DiSepio Institute for Rural Health and Wellness
- Also serves as Director of Saint Francis University's Orthopaedic Physical Therapy Residency program
- Is integrally involved in baseline and post injury testing and post injury rehabilitation
- Carries active caseload of patients experiencing prolonged recovery from concussion

Establishing Clinical Trajectories in Concussion Management

- Vestibular
- Ocular
- Cognitive/fatigue
- Post-traumatic migraine
- Cervical
- Anxiety/mood



The Cervical Spine Clinical Trajectory- Mechanism of Injury

- **Forces encountered by the head during concussion are often translated to the cervical spine as well**

- **In addition to concussion, the MOI may also cause injury to the cervical structures**
  - Spinal ligaments
  - Soft tissue injuries
  - The intervertebral disc
  - Vertebral arteries
  - The upper thoracic and TMJ regions should also be considered and screened

- **May result in whiplash-associated disorder**

Whiplash-Associated Disorder

- Presentation overlaps concussion
- 25% of patients have persistent symptoms lasting over 3 months
- Imaging normal in most circumstances

The Cervical Spine Clinical Trajectory- Clinical Presentation

- **Injury to the cervical spine may result in:**
  - Cervicogenic headaches
  - Decreased postural control
  - Decreased proprioceptive awareness
  - Decreased neuromuscular control of head movements
  - Dizziness/disequilibrium
  - Vestibulo-ocular disturbances
    - Oculomotor control
    - Smooth pursuits, gaze stability, blurred vision
    - Head/eye coordination
- **Gait disturbances**
- **Concentration difficulties**

Cervicogenic Dizziness

- **Cervical proprioceptive input is processed along with visual and vestibular input**
  - Cervico-ocular reflex
  - Vestiblo-ocular reflex
- **Dysfunction may impact:**
  - Head position/postural control
  - Oculomotor control
  - Vestibular function
- **Upper cervical dysfunction is most common**
- **Must differentiate from specific vestibular dysfunction**

Cervicogenic Headaches

- **Pain referral from the upper cervical spine joints**

- **Cervicogenic HA presentation**
  - Typically unilateral but can be bilateral
  - Provoked by neck movements or sustained positions
  - Aching, throbbing, spreads to eyes and frontal area
  - May present with photo/phonphobia, nausea, vomiting, dizziness, difficulty swallowing, blurred vision
  - Associated w/ decreased c-spine ROM, hypomobility

- **Differential diagnosis**
  - Tension headaches
  - Migraine without aura

The Cervical Trajectory: What May Standard Post-Concussion Assessments Show?

VOMS

- Increased headache and/or dizziness with smooth pursuits, VOR, convergence

ImPACT

- Abnormal Visual Motor Speed composite

PCSS

- Headache, nausea, dizziness, fatigue, numbness/tingling, visual problems

Exertion

- Not limited by cardiovascular threshold
- Headache may improve initially but return at higher intensity

Patient Examination

- **Thorough history**
  - **Concussion history**
    - # of concussions
    - Recovery process for each
- **Mechanism of injury and progression of symptoms**
- **Current symptoms**
  - What makes symptoms worse
  - Activity tolerance: (cognitive and physical)

Level 1 Assessment

- **Is the patient appropriate for physical therapy?**

- **R/O findings that would require immediate referral**
  - More severe brain injury
  - Cervical Spine injury

Level 1 Assessment

Signs of a more severe brain injury that may require immediate referral:

- Worsening headache
- Very drowsy or cannot be awakened
- Not recognizing people/places
- Repeated vomiting
- Confusion or very irritable
- Seizures
- Weakness or numbness in extremities
- Unsteadiness or slurred speech

Evaluating the Cervical Spine

Is the Patient Appropriate for PT? Red Flags

- **Spinal Fracture**
  - History of major trauma
  - Severe ROM restrictions
- **Canadian C-Spine Rule**
- **NEXUS Criteria**

Canadian C-Spine Rule: When are Radiographs Indicated?

- **≥ 1 high risk factor**
  - >65 years old
  - Paresthesias in extremities
  - Dangerous mechanism of injury
    - Fall from > 1 meter, MVA a speed > 60 mph or with rollover or ejection, bicycle collision, recreational vehicle accident
- **Inability to access ROM**
  - Patient unable to sit, ambulate, onset immediate, midline cervical tenderness, other high risk MVA
- **Patient unable to actively rotate 45º bilaterally**

- **Radiographs indicated if any of these are present**
  - Sensitivity 99%, Specificity: 45%

Canadian C-spine Rule: Exclusion Criteria

- Non-trauma cases.
- Glasgow Coma Scale < 15
- Unstable Vital Signs
- Age < 16 years.
- Acute paralysis.
- Known vertebral disease.
- Previous c-spine surgery.
- *Rule has only been validated in the adult population

NEXUS Criteria

Used to R/O vertebral fracture without imaging

- Can imaging be safely avoided?

Imaging not indicated if:

- No focal neurological deficit
- No midline spine tenderness
- No altered level of consciousness
- No intoxication
- No distracting injury present

Sensitivity of >99%

No age cut-offs (validation study was 1-101 y.o.)

- Sensitivity may be reduced >65 y.o.)

Is the Patient Appropriate for PT? Red Flags-Cervical Myelopathy

- **Central cord compression leading to a cascade of neurological symptoms.**
- **Etiology is generally cervical stenosis from spondylosis.**
  - Can be trauma/swelling
- **Several imaging modalities used to determine the diameter of the cervical canal including CT and MRI.**
- **Cervical stenosis is found in asymptomatic patients on MRI.**

Is the Patient Appropriate for PT? Red Flags

Cervical Myelopathy Signs and Symptoms

- Sensory disturbance in hands
- Muscle wasting of intrinsics
- Unsteady gait
- Positive UMN signs
- Hyperreflexia
- Bowel and bladder disturbance
- Multisegmental weakness and/or sensory changes

Cervical Myelopathy Test Cluster (Cook 2010)

- Gait deviation.
- +Babinski test.
- +Hoffman's test.
- Inverted supinator sign.
- Age > 45.

- **3 of 5 positive tests: + LR = 30.9.**
- **0-1 positive tests: -LR = 0.18, Sen. =.94.**

Other Conditions of the Spinal Cord

Cervical Cord Neuropraxia

- Essentially a concussion of the spinal cord
- Brief disturbance of sensation and/or ability to move
  - May last from a few seconds to 24 hours

Cervical Instability

- History of Trauma, whiplash.
- Patient reports difficulty holding up their head.
- Bilateral paresthesia's or other signs of cord compression.

Instability Screening Bottom Line

- Not well studied in the literature
- Cardinal signs and symptoms should warrant referral.
- Take extra care after whiplash and trauma.
- Test upper cervical instability prior to performing manual therapy in the C-spine.

Summary: Cervical Instability

Imaging warranted with Red Flag findings.

- History of trauma
- Headache, dizziness, neurological signs.
- Physical examination findings

- **MRI-upper cervical ligamentous signal intensity changes may not be related to recent whiplash injury.**

- **Correlate imaging with clinical findings.**

Examination of Neck Pain

Self report questionnaires

- **Neck Medical Screening Questionnaire**
  - Screen for red flags and psychosocial factors
- **Numeric pain scale and/or pain diagram**
- **Neck Disability Index**
  - MDC = 9%
  - May not be adequate for low levels of disability
- **Patient specific functional scale**
  - MDC = 1 (mechanical pain/no radiculopathy)
  - MDC = 2 (pts with cervical radiculopathy)
- **FABQ**
  - More studies for LBP, may be risk factor for prolonged disability in pts with neck pain
- **Post Concussion Symptom Scale (PCSS)**

Examination of Neck Pain

Upper Quarter Screen

- Suggested for all patients with symptoms that extend distal to the AC joint or if origin of symptoms unclear
- TMJ should also be screened

Postural Assessment

- Investigate the effects of sustained positions on symptom presentation

Examination of Neck Pain

Neurological Testing

LMN signs:

- Diminished or absent DTR's
- Decreased sensation
- Muscle weakness (myotomal)

UMN signs:

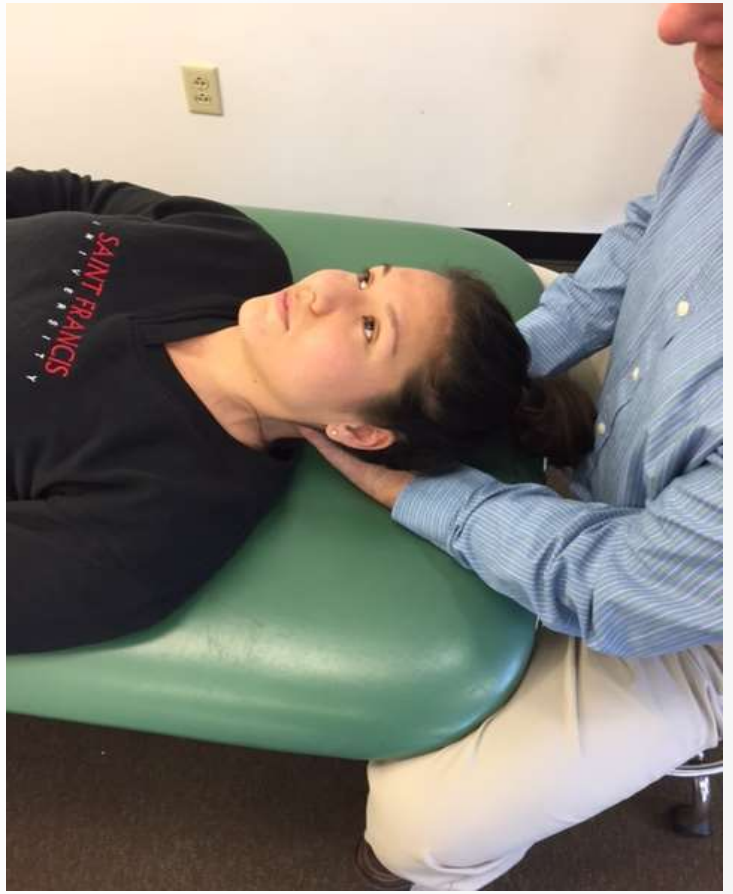
- Hyperreflexia of UE and LE
- Sensory changes in a non-dermatomal pattern
- Clonus
- Positive Hoffmann or Babinski
- Inverted Supinator Sign
- Weakness below level of compression
- Bowel/bladder disturbances
- Clumsiness or gait disturbance

Examination of Neck Pain

Ligamentous Instability Testing

Alar Ligament test

- Alar ligament stabilizes atlanto-occipital complex
  - Pt supine, stabilize axis with pad of thumb adjacent to spinous process
  - Therapist side bends pts head to opposite side
  - Spinous process should immediately move into thumb
  - Delay or lag suggests injury/laxity



Examination of Neck Pain

Ligamentous instability testing

Sharp-Purser test

- Tests integrity of cruciform ligament (transverse lig of dens)
- Identifies subluxation of atlas on axis
  - Pt seated, neck in 20-30 deg flexion, PT places palm over forehead while supporting spinous process of axis
  - PT applies posterior shearing force
  - Test positive if head slides posterior, meaning it relocated
  - A clunk may be heard/felt

Examination of Neck Pain

AROM assessment

- C spine: all planes of motion
- Upper thoracic assessment

Screening for TOS

- Especially indicated for pts w/ peripheralizing symptoms with contralateral sidebending.
- All tests in literature have low sensitivity/specificity
  - **Combination of tests increases accuracy of diagnosis**
    - Roos, Adsons, etc
    - Soft tissue assessment
    - 1st rib assessment

Examination of Neck Pain

Vertebrobasilar insufficiency testing

- **Screening prior to manual therapy is standard**
  - But also controversial

Tests:

- **Seated AROM**
  - Observe for vertigo, tinnitus, dizziness, visual-perceptual problems, fainting
- **Pre-manipulative hold**
  - Pt in tx position, count back from 15
  - Monitor for dizziness, diplopia, dysarthria, nystagmus, other cranial nerve symptoms
- **Minimized deKleyn Test**
- **Pt supine, head supported by PT off table**
  - PT passively rotates R/L, then ext w/ R/L rotation
  - Monitor for above signs and symptoms as pt counts back from 15
- **Any positive test requires medical referral**

Examination of Neck Pain

Joint Mobility Assessment

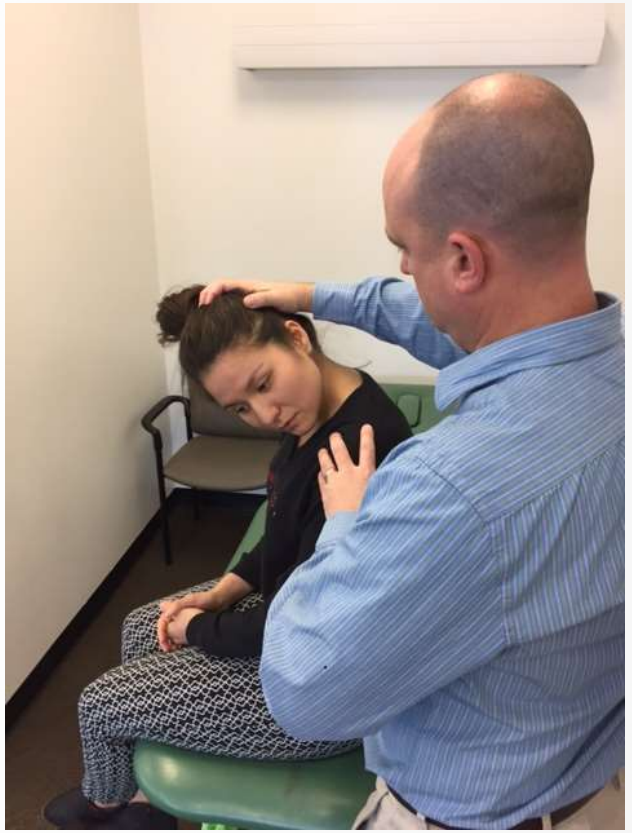
Joints to Assess:

- Fist rib
- Atlanto-occipital joint
- Atlanto-axial joint
- Lower C-spine (C2-C7)
- Upper thoracic spine (T1-T5)

Joint Mobility Assessment

First Rib:

- **Cervical rotation lateral flexion test**
  - Patient seated, rotate head maximally away from side tested
  - C-Spine then flexed (ear to sternum)
  - Results compared to opposite side (+ positive if different)



Joint Mobility Assessment

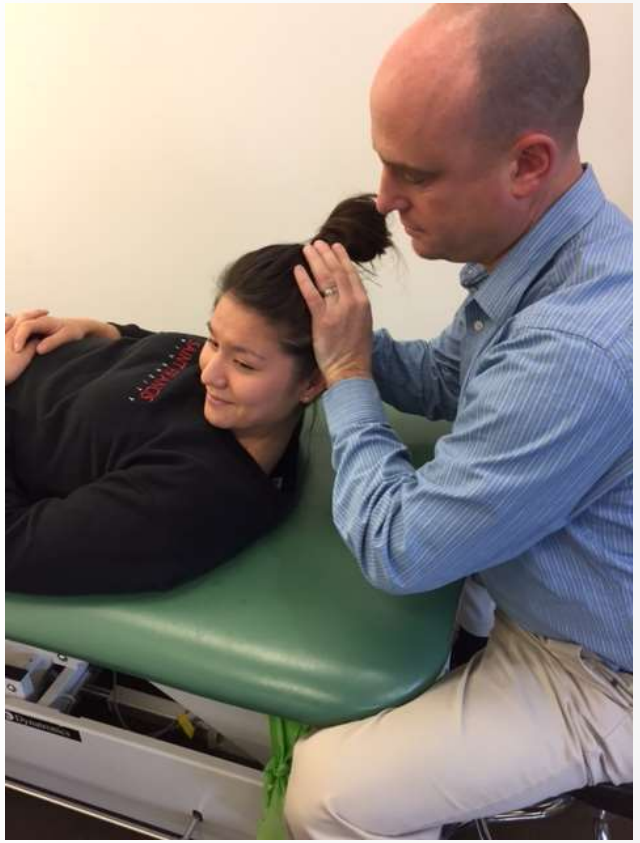
Atlanto-Occipital Joint

- **Primary motion is flexion/extension**
  - Assessed w/ pt supine
  - Rotate head ~30º, apply ant/post glide (flex/extend head)
  - Assess for amount and quality of motion, compare side/side

Joint Mobility Assessment

Atlanto-axial joint

- **Primary motion is rotation (flexion rotation test)**
  - Pt supine, passively flex neck maximally, then rotate
  - Assess amount and quality of motion, compare side/side



Joint Mobility Assessment

- Lower C-spine (C2-C7)
  - Assessed via side-glide movement
    - Pt supine, neck in neutral.
    - Glide bilaterally at each segment
      - Motion compared to opposite side
      - Pain provocation also recorded
  - May also be assessed via a spring test (also useful for thoracic spine)
    - Pt prone, use thumbs to apply central and unilateral P/A pressure

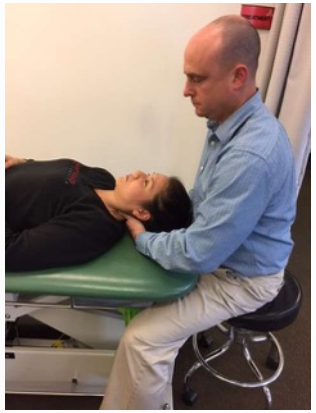


Image from Current Concepts in Orthopaedic Physical Therapy: Cervical Spine Monograph

Upper Cervical Spine and Headaches

- Flexion Rotation test showed average unilateral rotation of 27.6 degrees for headache patients, and 44.7 degrees for non symptomatic controls
- Flexion rotation test has Sensitivity of 91%, and Specificity of 90%
- Severity of headache is not correlated to degree of ROM restriction
- Side of C1 C2 restriction correlated with side of headache (*Hall and Robinson, 2004)*

Examination of Neck Pain

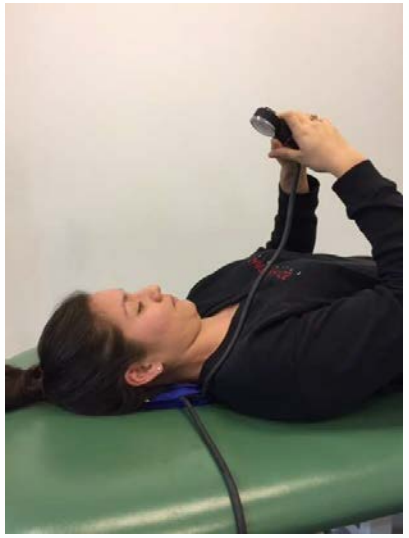
Assessment of Muscle Length

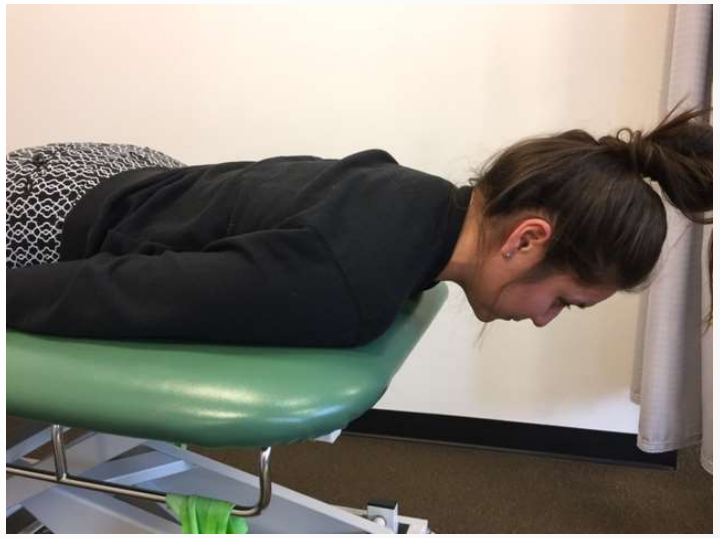
- Latissimus dorsi
- Pec Minor
- Levator scapulae, splenius cervicis, posterior scalenes
- Upper trapezius and SCM
- Anterior and middle scalene
- Serratus Anterior
- Pec Major
- Sub-occipitals

Examination of Neck Pain

Assessment of Muscle Strength and Endurance

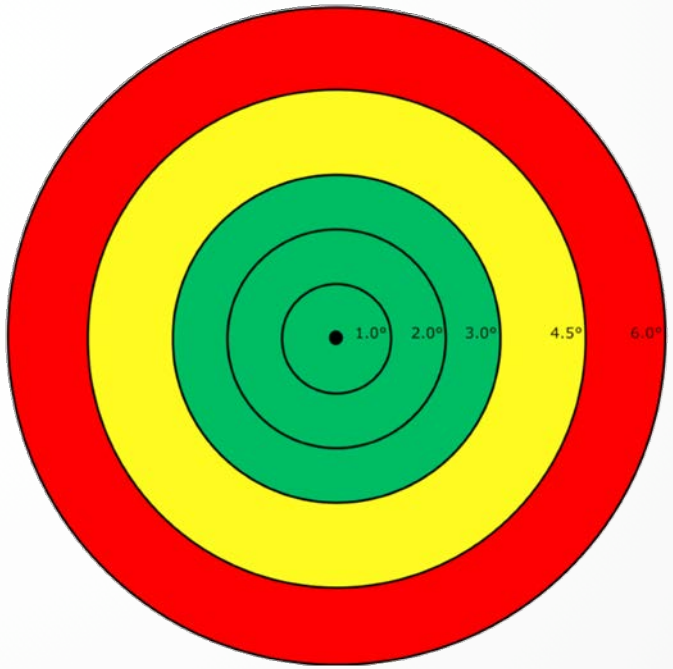
- Deep Cervical Flexor Endurance Test
- Cranio-cervical Flexor Endurance Test
- Neck Extensor Endurance Test





Testing for Proprioceptive Awareness

- **Joint Position Error/Head Repositioning Accuracy Test (cervicocephalic kinesthetic sensibility)**
- **Equipment**
    - Laser pointer, target, blindfold



Joint Position Error/Head Repositioning Accuracy Test

Procedure

- Patient positioned 90 cm from target (available online)
- Patient wears laser mounted to head with vision occluded
- Patient positioned at center target and instructed to remember position
- Clinician passively moves head to desired position and holds 2 seconds, then patient is asked to return to center position (distance from center recorded)
    - 3 trials each completed for left rotation, right rotation, flexion, extension

ICF Classification system proposed by Clinical Practice Guidelines

- Neck pain with mobility deficits
- Neck pain with headaches
- Neck pain with movement coordination impairments
- Neck pain with radiating pain

- Clinical Practice Guidelines available free at JOSPT.org

Neck Pain With Headaches

Findings

- Unilateral HA preceded by neck pain
- HA triggered by neck movement or position
- HA elicited by pressure on posterior neck (muscle or joint)
- Restricted ROM and/or joint mobility
- Restricted upper cervical mobility

Treatment

- Mobilization/manipulation
  - Particular attention to upper c-spine
- Soft tissue mobilization
- Strengthening
- POSTURAL EDUCATION

Neck Pain With Movement Coordination Impairments

Findings

- Lower pain and disability scores
- Longer duration of symptoms
- No nerve root compression or centralization/peripheralization with ROM
- General flexibility and strength deficits
- Weakness due to learned pain avoidance(not neuro)
- Postural abnormalities/ergonomic inefficiencies during activities

Treatment

- Strengthening and endurance exercise for neck and upper quarter
- Proprioceptive and dynamic resistive training
- Aerobic conditioning

Treatment of Cervical Spine Involvement

- **Posture education**
- **Manual therapy**
  - Soft tissue techniques
  - A/O mobilization
  - A/A mobilization
  - Lower cervical joint mobilizations
- **Targeted stretching/strengthening**
- **Proprioception training**

A/O Mobilization

- **Manual Joint mobilization**
  - Assessment becomes the treatment
- **Self mobilization**

A/A Mobilization

- **Muscle Energy Technique**
- **Self mobilization**

Lower Cervical Joint Mobilizations

- Central and unilateral P/A mobs
- Side glides
- Other specific mobilization techniques

Cervical Proprioception Exercises

- **Starts with posture correction and cervical stabilization exercises**
- **Get creative with exercise progression**
  - Alphabet/picture tracing, maze w/ laser, search for target exercises

Image from: www.eyecanlearn.com

Images from www.optp.com

Cervical Trajectory: A Summary of Relevant Research

- **For cervicogenic headaches, a combination of manual therapy and exercise has been shown to be more effective than a passive approach** (Hurwitz et al. *Spine* 2008)(Jull et al. *Spine* 2002)

- **For patients with c/o persistent dizziness, neck pain, and/or headaches**
  - a tx program of general exercises (AROM, stretching, posture re-ed, and exertion), vestibular rehab, and cervical physical therapy was 10.27 times more likely to result in patient returning to play in 8 wks than with general exercise alone

Summary

- The cervical clinical trajectory should be considered and investigated in concussion management
- The cervical spine can influence a variety of post concussion symptoms including headaches, dizziness, and vestibular-ocular function
- A thorough clinical exam as well as ImPACT scores, VOMS, and exertional tolerance should be considered in determining clinical trajectory(ies)
- If cervical involvement is suspected, early intervention should be considered to facilitate recovery

ConcussionManagement.com