CONCUSSION UPDATE: EVALUATION, RETURN TO LEARN AND RETURN TO PLAY CONSIDERATIONS

JENNIFER VOLBERDING PHD, LAT, ATC

ASSOCIATE PROFESSOR

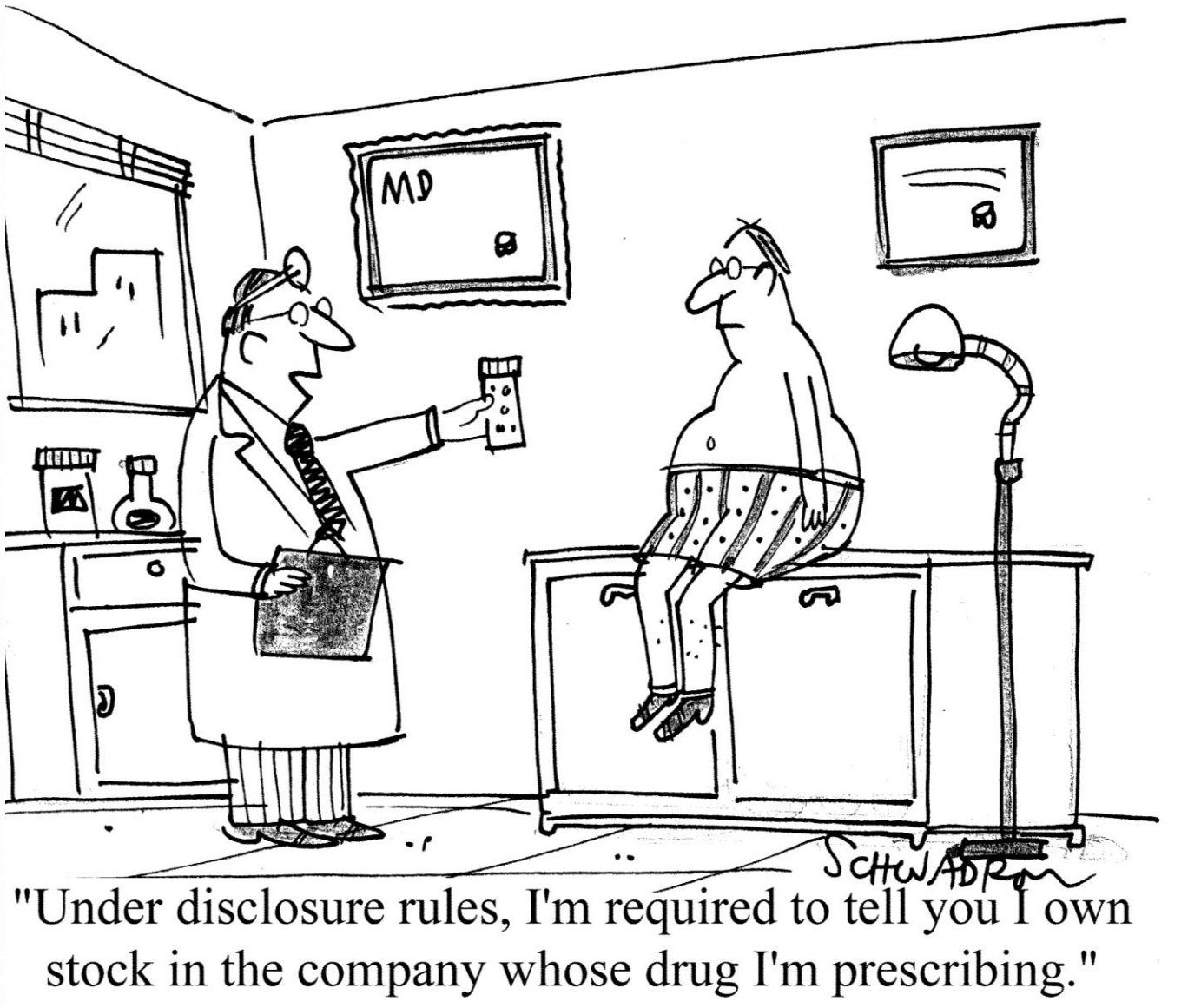
DEPARTMENT CHAIR ATHLETIC TRAINING

ATHLETIC TRAINING PROGRAM DIRECTOR

OKLAHOMA STATE UNIVERSITY CENTER FOR HEALTH SCIENCES

CONFLICT OF INTEREST

- NO DISCLOSURES



LEARNING OBJECTIVES

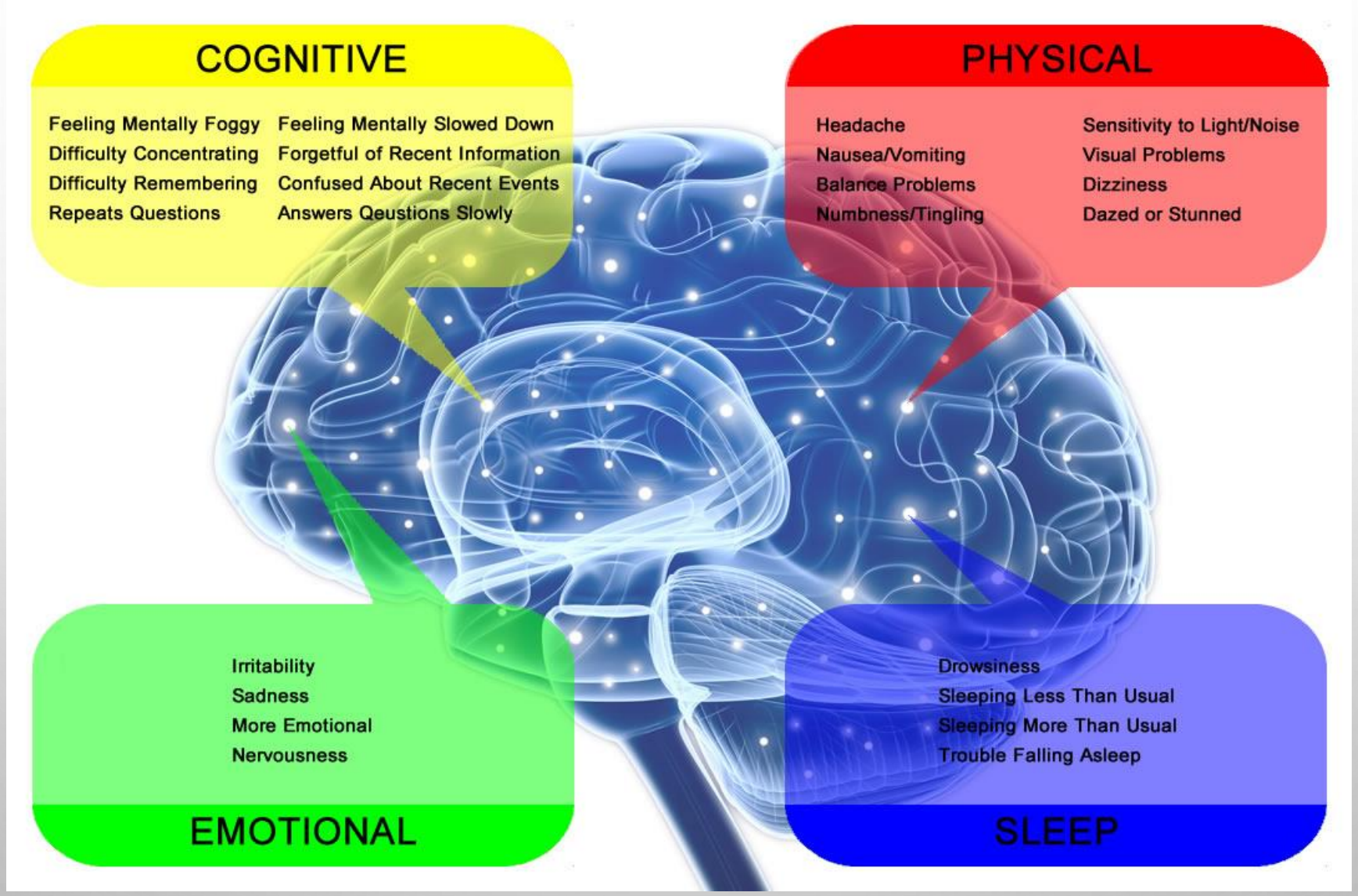
- IDENTIFY METHODS TO DETERMINE THE CAUSE OF DIZZINESS AND NAUSEA IN POST-CONCUSSIVE PATIENTS
- EVALUATE THE APPLICATION OF THE VOMS AND KING-DEVICK TESTS WHEN EVALUATING CONCUSSIONS
- DETERMINE THE BEST TREATMENT PLAN FOR PATIENTS TO RETURN TO FULL ACTIVITY POST-CONCUSSION

CONCUSSION

Trauma-induced alteration in mental status that may or may not involve a loss of consciousness

What it is not….

Ding	Getting bell rung	Fuzziness	Cobwebs


COGNITIVE
Feeling Mentally Foggy
Feeling Mentally Slowed Down
Difficulty Concentrating
Forgetful of Recent Information
Difficulty Remembering
Confused About Recent Events
Repeats Questions
Answers Qeustions Slowly
PHYSICAL
Headache
Sensitivity to Light/Noise
Nausea/Vomiting
Visual Problems
Balance Problems
Dizziness
Numbness/Tingling
Dazed or Stunned
Irritability
Sadness
More Emotional
Nervousness
EMOTIONAL
Drowsiness
Sleeping Less Than Usual
Sleeping More Than Usual
Trouble Falling Asleep
SLEEP

RISK FACTORS FOR CONCUSSION AND IMPLICATIONS ON RECOVERY[1]

Symptoms

- Number
- Duration (longer than 10 days)
- Severity

Signs

- Prolonged loss of consciousness (greater than 1 minute)

Sequelae

- Concussion convulsions

RISK FACTORS FOR CONCUSSION AND IMPLICATIONS ON RECOVERY[1]

Temporal

- Frequency: repeated concussions over time
- Time: close together
- Recency: recent concussion or TBI

Threshold

- Repeated concussions occurring with progressively less impact, force, or slower recovery after each successive event

Age

- Child or adolescent

RISK FACTORS FOR CONCUSSION AND IMPLICATIONS ON RECOVERY[1]

Comorbidities and pre-morbidities

- Migraine, depression, or other mental health disorders, ADD or ADHD, learning disabilities, sleep disorders

Medication

- Psychoactive drugs, anticoagulants

Behavior

- Dangerous style of play

Sport

- High risk activity, contact or collision sport, high sporting level

CONCUSSION EVALUATION MULTI-FACETED APPROACH[1]

- SYMPTOMS
- CLINICAL EVALUATION
- VISION
- BALANCE/MOTOR CONTROL
- COGNITIVE

SELF-REPORTED SYMPTOM ASSESSMENT

- SYMPTOM CHECKLIST
- SCALED (SUMMED OR GRADED THAT ASSESS SEVERITY OR DURATION)
- BE AWARE OF DEHYDRATION, FATIGUE, AND OTHER FACTORS
- RECOGNIZE THAT UNDERREPORTING IS MOST LIKELY TO OCCUR

CONCUSSION SYMPTOM INVENTORY (CSI)[2]

Concussion Symptom Inventory (CSI)
Randolph, Millis, Barr, McCrea, Guskiewicz, & Kelly (2008)

Player Name:_____
Date of Injury:_____ Date of Exam:_____

	absent *mild* *moderate* *severe* 0 1 2 3 4 5 6	Score
Headache		
Nausea		
Balance Problems/Dizziness		
Fatigue		
Drowsiness		
Feeling like "in a fog"		
Difficulty concentrating		
Difficulty remembering		
Sensitivity to light		
Sensitivity to noise		
Blurred vision		
Feeling slowed down		
TOTAL:		

Other symptoms evident since injury?:

GRADED SYMPTOMS CHECKLIST (GSC)[3]

Graded Symptom Checklist (GSC)

Symptom	Time of injury	2-3 Hours postinjury	24 Hours postinjury	48 Hours postinjury	72 Hours postinjury
Blurred vision					
Dizziness					
Drowsiness					
Excess sleep					
Easily distracted					
Fatigue					
Feel "in a fog"					
Feel "slowed down"					
Headache					
Inappropriate emotions					
Irritability					
Loss of consciousness					
Loss or orientation					
Memory problems					
Nausea					
Nervousness					
Personality change					
Poor balance/coordination					
Poor concentration					
Ringing in ears					
Sadness					
Seeing stars					
Sensitivity to light					
Sensitivity to noise					
Sleep disturbance					
Vacant stare/glassy eyed					
Vomiting					

NOTE: The GSC should be used not only for the initial evaluation but for each subsequent follow-up assessment until all signs and symptoms have cleared at rest and during physical exertion. In lieu of simply checking each symptom present, the ATC can ask the athlete to grade or score the severity of the symptom on a scale of 0-6, where 0=not present, 1=mild, 3=moderate, and 6=most severe.

CLINICAL EVALUATION

- RULE OUT CERVICAL SPINE IMPLICATIONS
  - STRESS TESTING
    - SHARP-PURSER
    - ALAR LIGAMENT
    - VERTEBROBASILAR INSUFFICIENCY
  - JOINT POSITION ERROR (JPE) TEST
  - ROM
  - PALPATION
- VESTIBULAR/OCULAR EVALUATION
  - HEAD THRUST
  - DIX-HALPIKE
  - VOMS
  - BALANCE ASSESSMENT

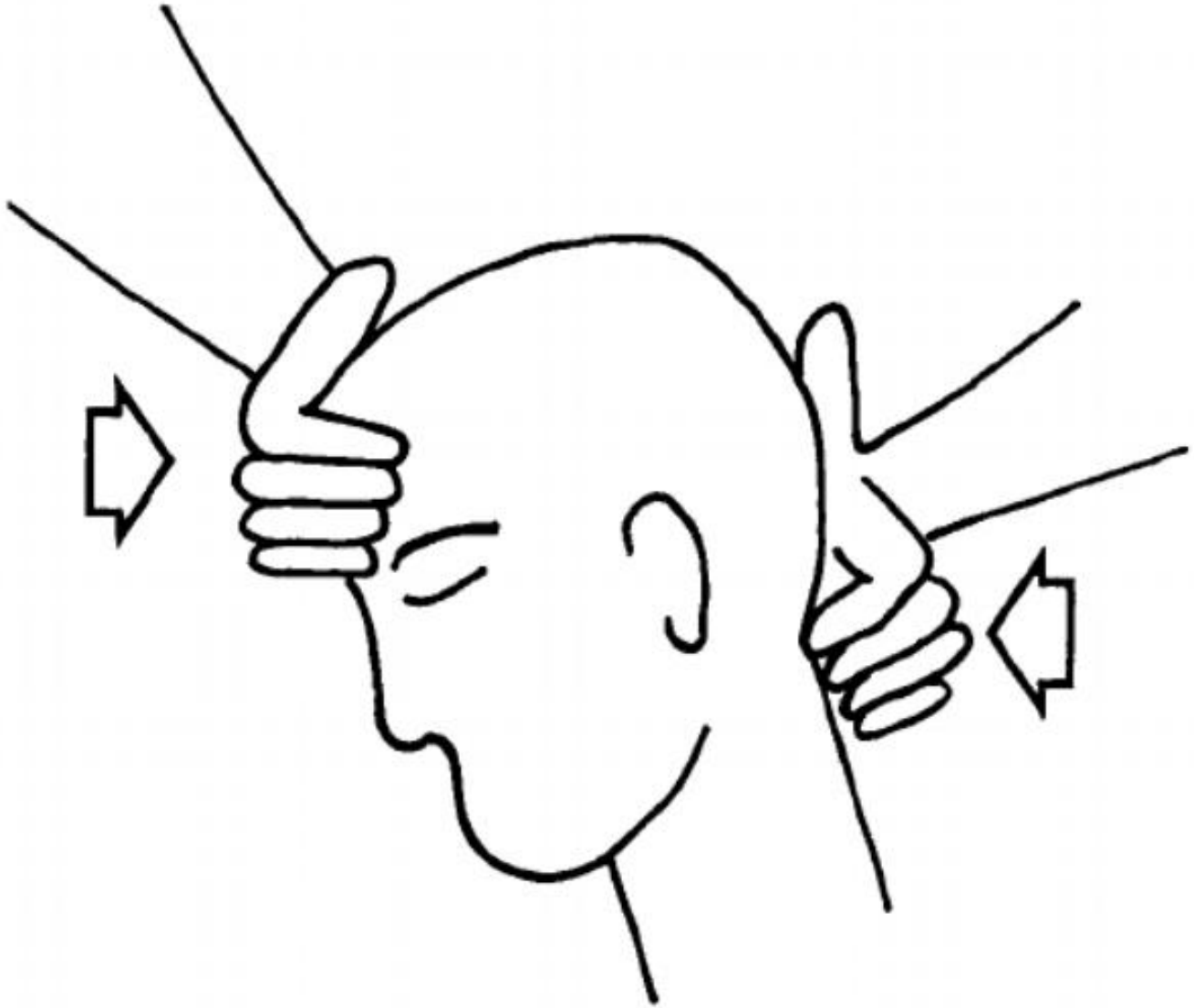


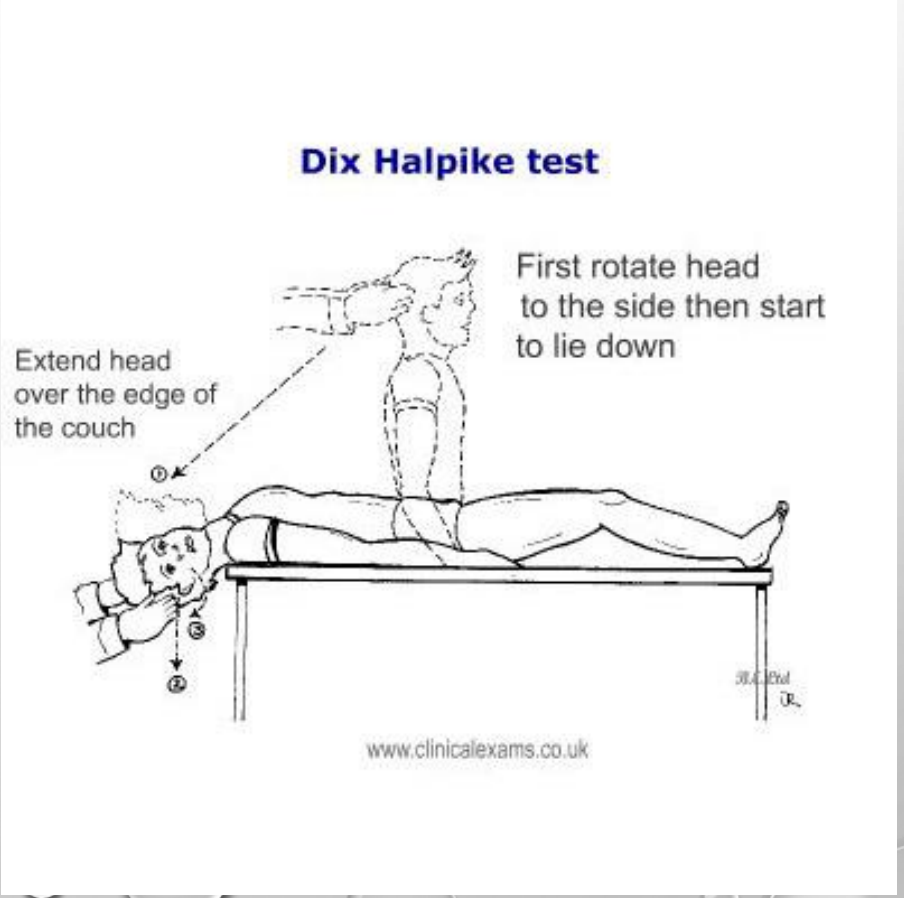
Figure 3. The Sharp-Purser test for abnormal clinical laxity of the atlantoaxial complex. The patient is seated, with the neck voluntarily slightly flexed. Pressure is applied to the forehead, forcing the occiput to glide into extension over the index finger at C2.

SHARP PURSER TEST[4]

ASSESS ATLANTOAXIAL INSTABILITY

DIX-HALPIKE[5]

- USED TO RULE OUT VERTIGO



VBI[6]

- VERTEBRAL ARTERY INSUFFICIENCY SCREENING
  - DECREASED BLOOD FLOW OF THE INTERCRANIAL VERTEBRAL ARTERY OF THE CONTRALATERAL SIDE
  - CAUSES ISCHEMIA AND REPRODUCES DIZZINESS, NAUSEA, SYNCOPE, DYSARTHRIA, DYSPHAGIA, AND DISTURBANCE OF THE HEARING OR VISION

FIGURE 1. Vertebrobasilar insufficiency screening procedure: end range cervical spine rotation with the patient supine.

FIGURE 2. Vertebrobasilar insufficiency screening procedure: end range cervical spine extension with the patient supine.

JPE[7]

- LASER AND TARGET
- JOINT REPOSITIONING
  - EYES CLOSED
- CONSISTENCY IN EACH DIRECTION
- 4.5° STANDARD ERROR

VESTIBULAR/OCULAR MOTOR SCREEN (VOMS)[8]

- 5 COMPONENTS
  - SMOOTH PURSUITS
  - HORIZONTAL AND VERTICAL SACCADES
  - NEAR POINT CONVERGENCE (NPC) DISTANCE
  - HORIZONTAL VESTIBULAR OCULAR REFLEX (VOR)
  - VISUAL MOTION SENSITIVITY (VMS)
- MEASURE SYMPTOMS BEFORE AND AFTER EACH TEST
- DOES NOT REQUIRE A BASELINE AS COMPARISON
- HIGH INTERNAL CONSISTENCY ALPHA = 0.92
- VOR AND VMS MOST PREDICTIVE
- ANY SCORE GREATER THAN 2 INCREASES PROBABILITY OF CORRECTLY DIAGNOSING CONCUSSION
- HTTPS://WWW.YOUTUBE.COM/WATCH?V=XLA_WJAMBMG

Vestibular/Ocular-Motor Screening (VOMS) for Concussion

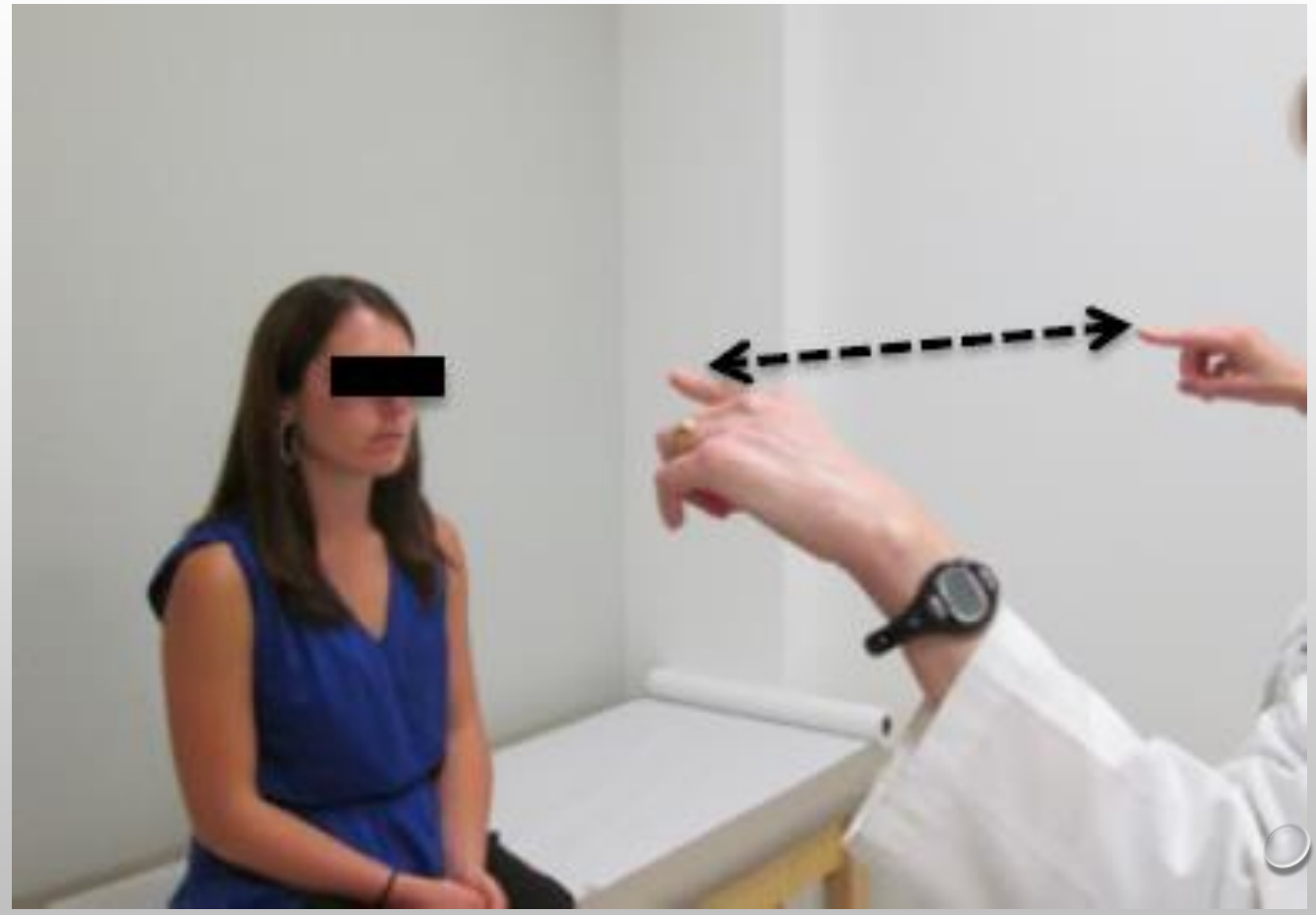
Vestibular/Ocular Motor Test:	Not Tested	Headache 0-10	Dizziness 0-10	Nausea 0-10	Fogginess 0-10	Comments
BASELINE SYMPTOMS:	N/A					
Smooth Pursuits						
Saccades – Horizontal						
Saccades – Vertical						
Convergence (Near Point)						(Near Point in cm): Measure 1: _____ Measure 2: _____ Measure 3: _____
VOR – Horizontal						
VOR – Vertical						
Visual Motion Sensitivity Test						

SMOOTH PURSUITS

- SLOW MOVING TARGET
- 3 FT FROM PATIENT
- PATIENT MOVES THEIR EYES NOT THEIR HEAD
- 1.5 FT TO THE RIGHT/LEFT AND UP/DOWN
- 2 REPETITIONS OF EACH

SACCADIC MOVEMENT

- QUICK EYE MOVEMENTS BETWEEN TARGETS
- 3 FT FROM PATIENT
- 1.5 FT TO THE RIGHT/LEFT AND UP/DOWN
- 10 REPETITIONS

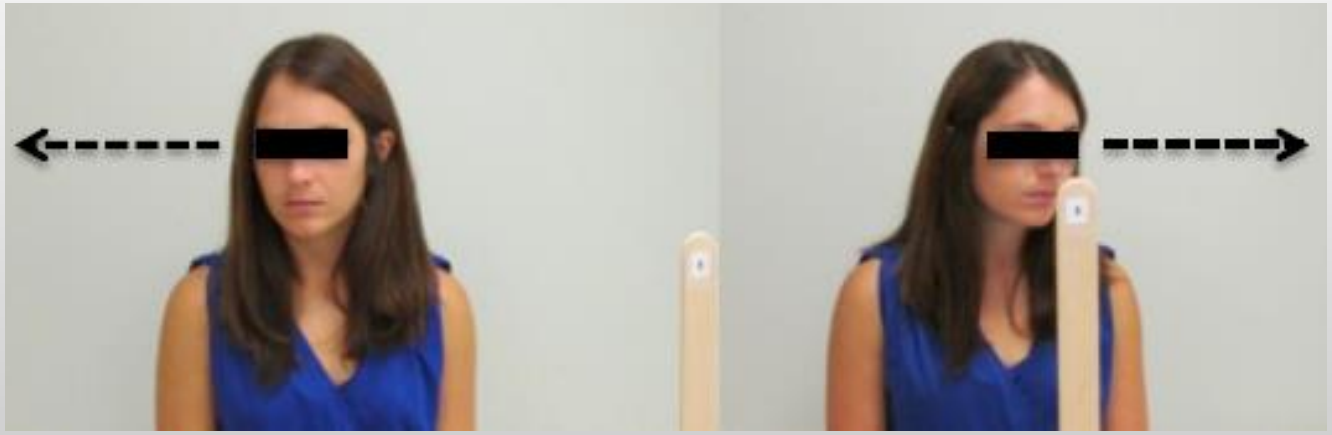


CONVERGENCE

- 14 POINT FONT
- WEAR ANY LENS CORRECTION THEY HAVE
- MEASURE DISTANCE IN CM FROM OBJECT TO NOSE WHEN DOUBLE VISION IS REPORTED

VESTIBULO-OCULAR REFLEXT

- 14 POINT FONT
- 3 FT AWAY FROM PATIENT
- 20 DEGREES TO RIGHT/LEFT AND UP/DOWN
- 180 BEATS/MIN
- 10 REPETITIONS

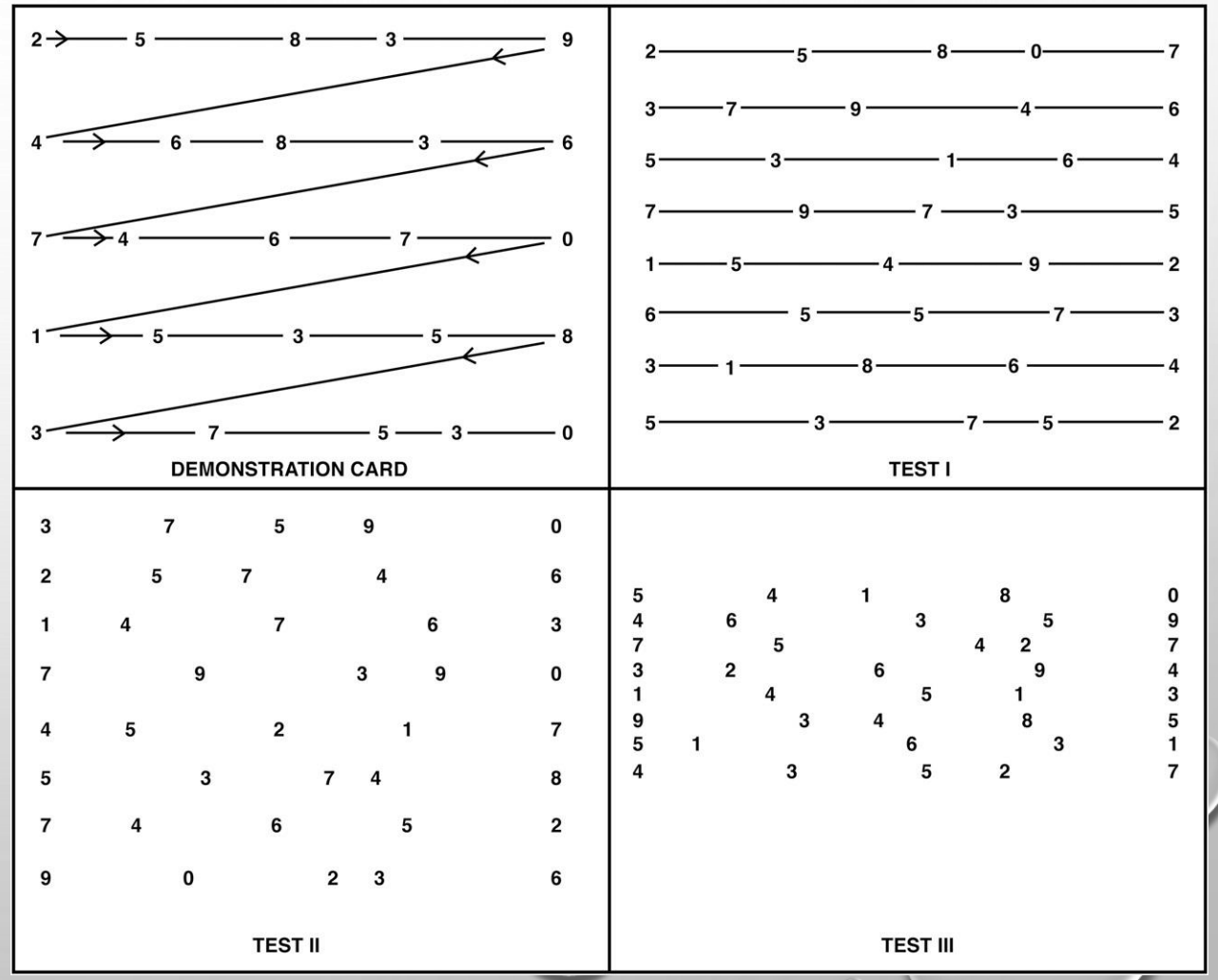


VISUAL MOTION SENSITIVITY

- STAND WITH ONE THUMB AT ARMS LENGTH
- ROTATE 160 DEGREES
- 50 BEATS/MIN
- 5 REPETITIONS

KING-DEVICK TEST[9,10]

- EXCELLENT FOR SIDELINE EVALUATION OF SACCADES
  - SENSITIVITY =86%
  - SPECIFICITY = 90%
- PATIENT READS THE NUMBERS ON EACH CARD FROM LEFT TO RIGHT AS QUICK AS POSSIBLE
- SUM OF TIMES FROM EACH CARD IS SCORE
- RECORD ERRORS
- COMPARED TO BASELINE
  - AVERAGE TIME IS 43.8 SECONDS
  - COLLEGE ATHLETES UNDER 1 MIN
  - YOUNG ADOLESCENTS LESS THAN 2 MIN
- WORSENING OF SCORE FROM BASELINE 5 TIMES GREATER LIKELIHOOD OF CONCUSSION
- WHEN COMPARED TO OTHER COMMONLY UTILIZED CONCUSSION EVALUATION TECHNIQUES IT DEMONSTRATES GREATEST CAPACITY FOR DIAGNOSIS

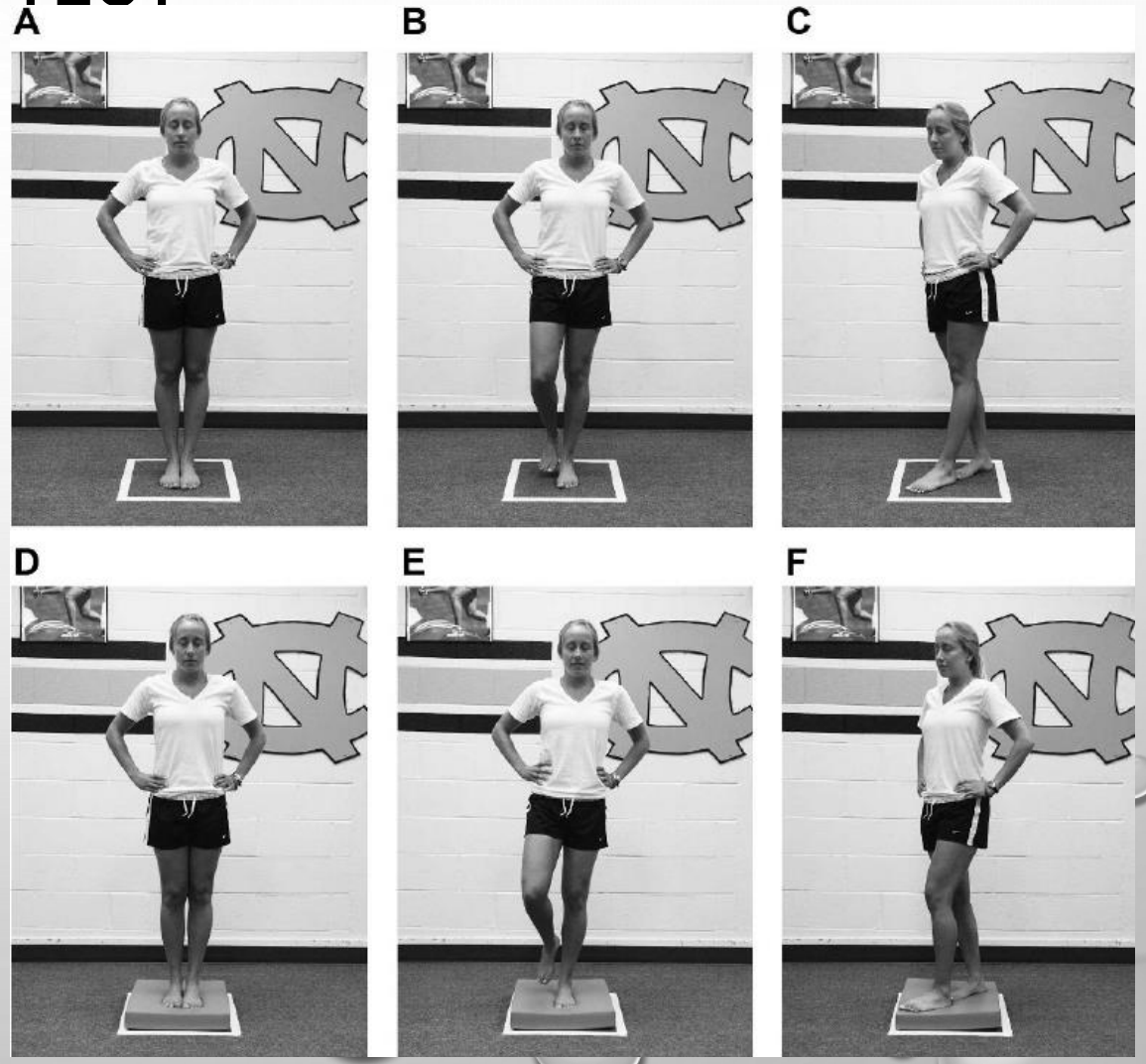


TESTING MOTOR CONTROL

- GAIT, POSTURE, HAND MOVEMENT
- POSTURAL CONTROL IS THE MOST RECOMMENDED AND EASIEST

BESS TEST[11]

- BALANCE EVALUATION
- VALIDATED TO DETECT LARGE DIFFERENCES DUE TO CONCUSSION
- MAY NOT BE BEST WHEN NEARING END OF CONCUSSION TREATMENT TIMELINE AS NOT GREAT FOR SUBTLE DIFFERENCES
- GOOD RELIABILITY FOR STATIC BALANCE



IMPACT TEST[12]

- NEUROCOGNITIVE TEST
  - ONLINE DELIVERY
  - MEASURES:
    - SYMPTOMS CHECKLIST
    - ATTENTION SPAN
    - WORKING MEMORY
    - SUSTAINED AND SELECTIVE ATTENTION TIME
    - RESPONSE VARIABILITY
    - NON-VERBAL PROBLEM-SOLVING
    - REACTION TIME
- CONSIDERATIONS:
  - CULTURAL COMPETENCE
  - LANGUAGE

SPORT CONCUSSION ASSESSMENT TOOL-5[13]

- COMPREHENSIVE BATTERY THAT INCLUDES:
  - SYMPTOM EVALUATION
  - COGNITIVE SCREENING
    - IMMEDIATE MEMORY
  - CONCENTRATION
    - MONTHS IN REVERSE ORDER
    - NUMBERS BACKWARDS
  - NEUROLOGICAL SCREEN
  - BESS
  - DELAYED RECALL
- CREATED BY THE CONCUSSION IN SPORT GROUP

SWAY[14]

- MOBILE DEVICE APPLICATION
- MAIN FOCUS IS BALANCE
- COGNITIVE
  - REACTION TIME
  - IMPULSE CONTROL
  - INSPECTION TIME
  - MEMORY
- SYMPTOM TRACKING
- IT IS A FDA CLASS II DEVICE
- NOT A STANDALONE DIAGNOSTIC TOOL

- BENEFITS
  - BASELINE COMPARATIVE MEASURE
  - QUICK
  - COST EFFECTIVE
  - EASY TO USE
- NEGATIVES
  - ALL PUBLISHED RESEARCH IS ON THE BALANCE COMPONENT
  - LACKS RESEARCH ON THE COGNITIVE COMPONENT

CONCUSSION TREATMENT

- TREAT THE SYMPTOMS
- REST
- ADDRESS THE VESTIBULAR/OCULAR SYMPTOMS

GAZE STABILIZATION

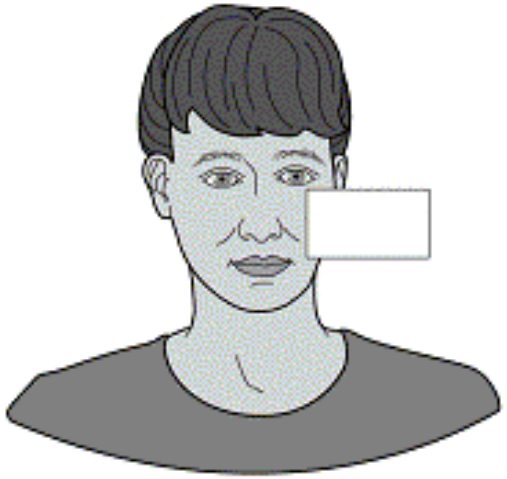


Figure 2A: Look straight ahead.

Figure 2B: Turn your head 45 degrees towards the right.

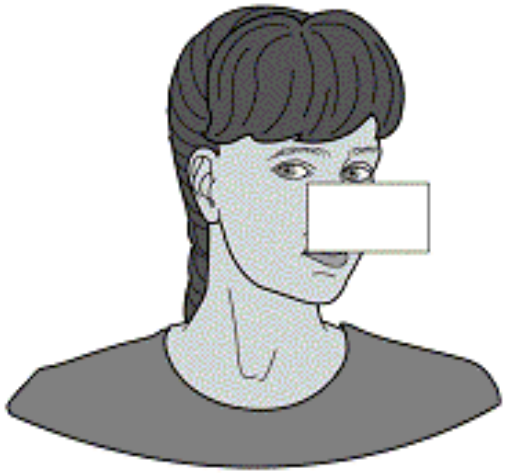
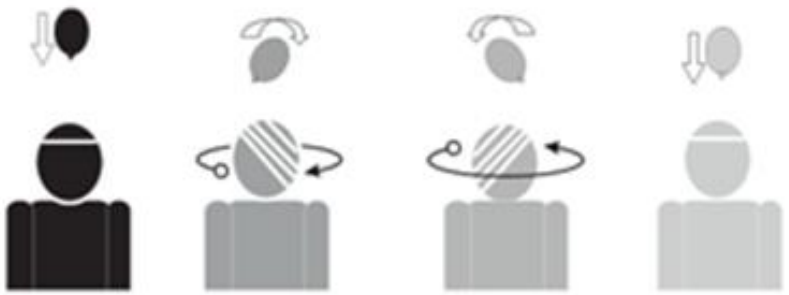


Figure 2C: Turn your head 45 degrees towards the left.

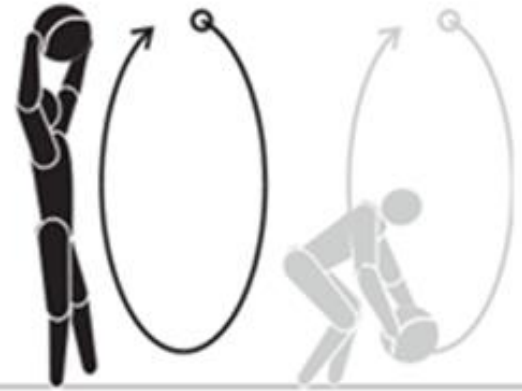
Note: Business card should be positioned at eye level.

Habituation

Horizontal Head Movements



Ball Circles



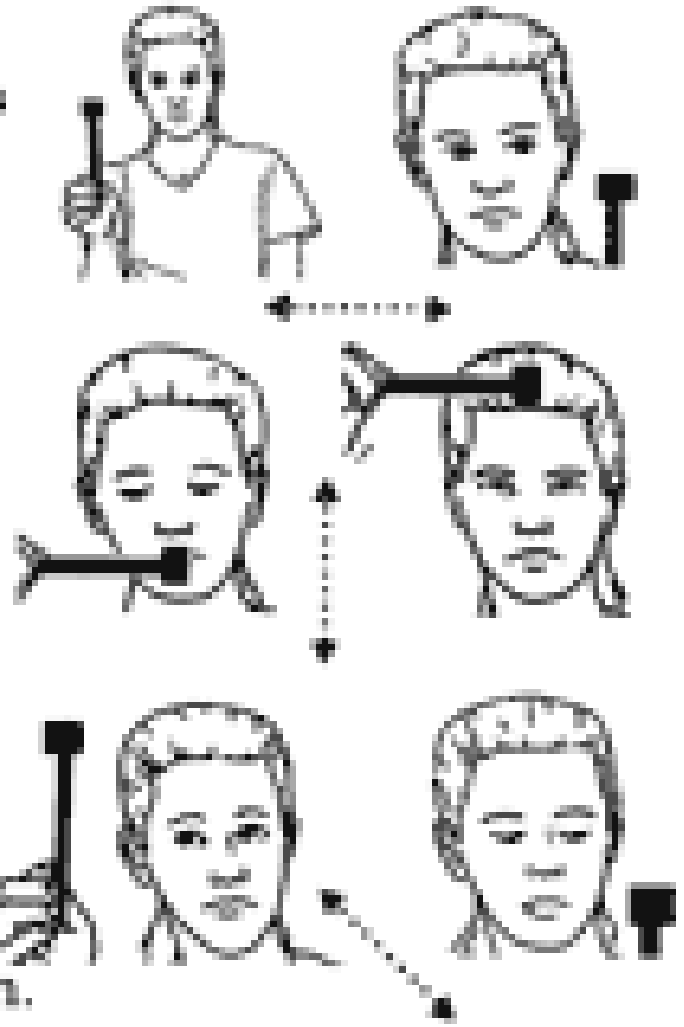
Head Circles

Gait with Head Turns

EYE EXERCISES - 5

Oculomotor: Smooth Pursuits

Holding a single target,
keep eyes fixed on target.
Slowly move it
SIDE TO SIDE /
UP-DOWN /
DIAGONALLY
while head stays still.



Perform in

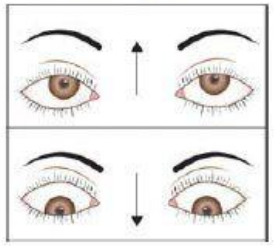
_____ position.

Move ____ seconds
each direction.

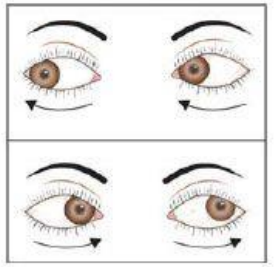
Repeat ____ times per session.

Do ____ sessions per day.

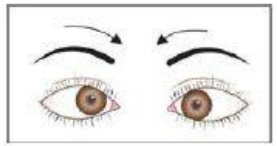
Exercises in bed



- Looking up and then down

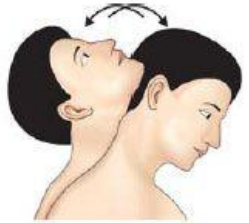


- Looking alternatively left and right

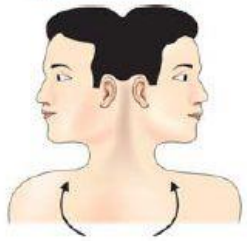


- Convergence exercises

Head movements

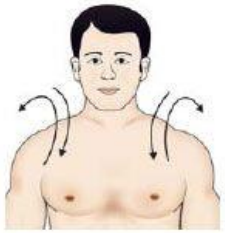


- Bending alternately forward and backward



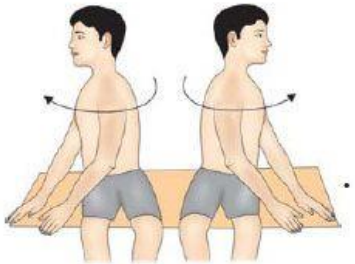
- Turning alternately to left and then right

Exercises in sitting position



- Shrugging and rotating shoulders

- Bending forward and picking up objects



- Turning head and trunk alternately to the left and right

RETURN TO LIFE[1]

- REST AT HOME
- EMOTIONAL IMPACT
- PHYSICAL IMPACT

- MEDICATIONS
  - SLEEP AIDS OR ANXIETY IN SUB-ACUTE STAGE

- DIET
  - HYDRATION
  - BALANCED NUTRITION
  - NO ALCOHOL WHILE STILL EXPERIENCING SYMPTOMS

RETURN TO SCHOOL[1]

- WHAT IS COGNITIVE REST
  - REDUCE BUT DON'T COMPLETELY REMOVE
  - STRICT BRAIN REST MAY HAVE DETRIMENTAL EFFECTS ON PATIENTS

- FIND BALANCE OF WORK WITH CONCUSSION SYMPTOMS

RESOURCES FOR RETURN TO LIFE AND LEARN FOR PATIENTS WITH LONG-TERM POST-CONCUSSIVE SYMPTOMS

- NEUROPSYCHOLOGISTS
  - COGNITIVE DECLINE
  - DECREASE IN ACADEMIC PERFORMANCE
  - EMOTIONAL DISTURBANCES
- POTENTIAL EVALUATION COMPONENTS
  - INTELLIGENCE
  - FLUID REASONING
  - CRYSTALIZED KNOWLEDGE
  - VISUAL PROCESSING
  - AUDITORY PROCESSING
  - SHORT TERM MEMORY
  - LONG TERM MEMORY
  - PROCESSING SPEED
  - ATTENTION
  - SENSORY MOTOR

RETURN TO PLAY[1]

Rehabilitation Stage	Functional Exercise	Objective
1. No activity	Complete physical and cognitive rest	Recovery
2. Light aerobic activity	Walking, swimming, stationary cycling. Mild intensity	Increase HR
3. Sport-specific activity	Running or skating drills. No head impact activities	Add movement
4. Non-contact training drills	Progression to more complex training drills	Exercise, coordination, cognitive load
5. Full contact practice	Following medical clearance. Normal training activities	Restore confidence, assessment of functional skills by coaching staff
6. Return to play	Normal game play	

SHOULD WE ALLOW EARLY EXERCISE (WITHIN THE FIRST 7 DAYS)????

- CURRENT RETURN TO PLAY STATES NO EXERCISE UNTIL SYMPTOMS RESOLVE, BUT IS THIS WHAT THE CURRENT LITERATURE STATES?
  - THERE HAS NOT BEEN AN UPDATE TO THE BEST PRACTICES BUT CURRENTLY LITERATURE STATES THAT EARLY EXERCISE MAY BE BENEFICIAL
  - LAWRENCE, RICHARDS, COMPER AND HUTCHISON 2018
    - EARLIER ACTIVITY LEADS TO A QUICKER RETURN TO PLAY AND RETURN TO WORK/SCHOOL
    - BUT CONCUSSION HISTORY, SYMPTOM SEVERITY, AND LOC HISTORY PLAYED A ROLE IN RETURN
  - BUCKLEY, MUNKASY, CLOUSE 2016
    - EARLY ACTIVITY (PHYSICAL AND COGNITIVE) BECAME ASYMPTOMATIC EARLIER
    - LIGHT ACTIVITY IS BEST
  - GROOL ET AL 2016
    - EARLY ACTIVITY REDUCED THE RISK OF PERSISTENT POST-CONCUSSIVE SYMPTOMS IN ADOLESCENTS

BUFFALO CONCUSSION TREADMILL TEST (BCTT)[15]

- ASSISTS WITH DETERMINING RECOVERY
- MEASURES AMOUNT OF AEROBIC EXERCISE THAT IS SAFE TO PERFORM
- HR AT SYMPTOM EXACERBATION IS THE HEART RATE THRESHOLD
- BIKE VERSION IS AVAILABLE AS WELL

QUESTIONS

- WHAT ARE SIGNS AND SYMPTOMS THAT DISTINGUISH BETWEEN A CONCUSSION YOU CAN TREAT CONSERVATIVELY AT HOME VERSUS ONE THAT MAY REQUIRE BRAIN IMAGING AND/OR MORE DILIGENT MONITORING OR NEURO CHECKS?

- DO YOU BELIEVE THERE ARE LEGAL IMPLICATIONS IN REGARDS TO TOO MUCH TESTING WITH PROGRAMS (I.E. IMPACT, SWAY, KING DEVICK AND ALLOW RTP EVEN THOUGH NOT 100% BACK TO BASELINE ON TESTING)? ALSO ANY ISSUES TO CONSIDER WITH SOME OF THESE COMMONLY USED PROGRAMS NOT BEING FDA APPROVED FOR CONCUSSIONS?

- RECOMMENDED SUPPLEMENTS TO HELP WITH CONCUSSION PREVENTION OR RECOVERY OVERALL OR FOR SPECIFIC SYMPTOMS? (FISH OIL, MAGNESIUM, B VITAMINS, ALA, VIT D ETC.) DIET? (HIGHER FAT)? OR THOUGHTS ON OTHER FRINGE TREATMENTS (HYPERBARIC, OZONE THERAPY)?

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