



Matthew J. Morahan, III
Health Assessment Center for Athletes
RWJBarnabas Health

The Pillars of Concussion Management

Diana Toto, M.S.
Program Director

Matthew J. Morahan III Health Assessment Center for Athletes
Sports Medicine and Business Development

RWJBarnabas
HEALTH



Matthew J. Morahan, III
Health Assessment Center for Athletes

RWJBarnabas
HEALTH

Morahan Center CAARP™

Comprehensive
Academic
Active
Recovery
Plan



Matthew J. Morahan, III
Health Assessment Center for Athletes

RWJBarnabas
HEALTH

Grades Don't Just Happen in Class

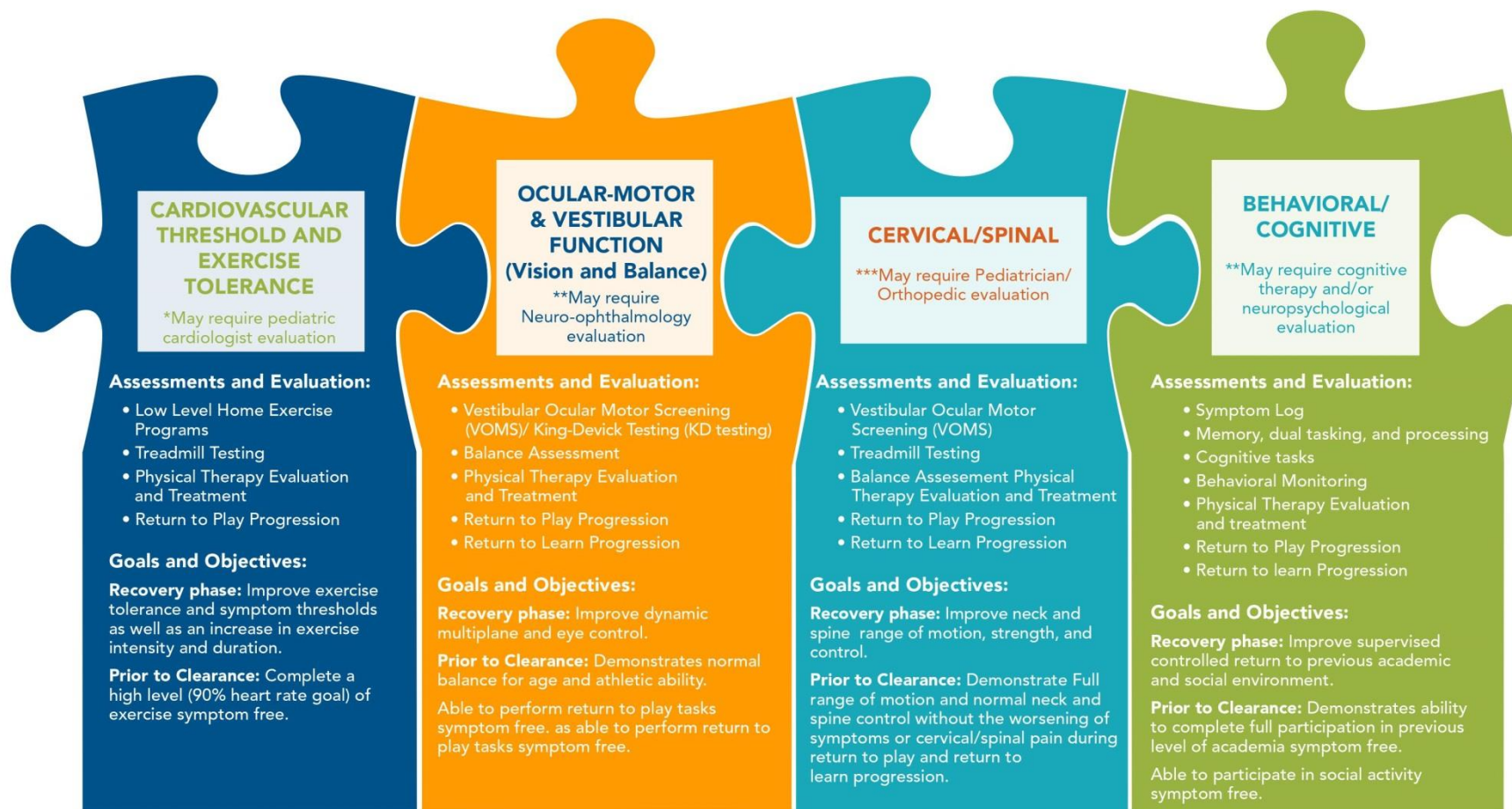
Concussion Grade	Cantu Grading System (2001 Revision)	1991 Colorado Medical Society Guidelines	1997 American Academy of Neurology (AAN) Guidelines
Grade 1 (mild)	<ul style="list-style-type: none"> •No (LOC) •Either PTA or post-concussion signs and symptoms that clear in less than 30 minutes 	<ul style="list-style-type: none"> •Transient mental confusion •No PTA •No LOC 	<ul style="list-style-type: none"> •No LOC •Transient confusion •Post-concussion symptoms clear in less than 15 minutes
Grade 2 (moderate)	<ul style="list-style-type: none"> •LOC lasting less than 1 minute and PTA or •Post-concussion symptoms lasting longer than 30 minutes but less than 24 hours 	<ul style="list-style-type: none"> •No LOC •Confusion with PTA 	<ul style="list-style-type: none"> •No LOC •Post-concussion symptoms last more than 15 minutes
Grade 3 (severe)	<ul style="list-style-type: none"> •LOC lasting more than 1 minute or •PTA lasting longer than 24 hours or •Post-concussion signs or symptoms lasting longer than 7 days 	<ul style="list-style-type: none"> •Any LOC, however brief 	<ul style="list-style-type: none"> •Any LOC, either brief (seconds) or prolonged (minutes)

"A decade ago, young athletes who suffered what the old grading scales would have considered "mild" or Grade 1 concussions would have been routinely allowed return to sports in as little as 15 minutes (Cantu) to 30-minutes (AAN) after his or her symptoms were thought to have cleared."



Concussion Pillars for Recovery

ALL PILLAR GOALS MUST BE ACCOMPLISHED PRIOR TO CLEARANCE TO RETURN TO FULL ACADEMICS AND SPORT.



Matthew J. Morahan, III
Health Assessment Center for Athletes
RWJBarnabas Health

Barnabas Health
Ambulatory Care Center

RWJBarnabas
HEALTH

Let's be healthy together.

Definitions

NATA

The 2014 National Athletic Trainers' Association (NATA) position statement on the management of sport-related concussion (SRC) define *concussion* as a brain injury resulting from biomechanical forces producing a complex **pathophysiological** process that typically results in the rapid onset of short-lived **impairment of neurologic function** that resolves spontaneously.

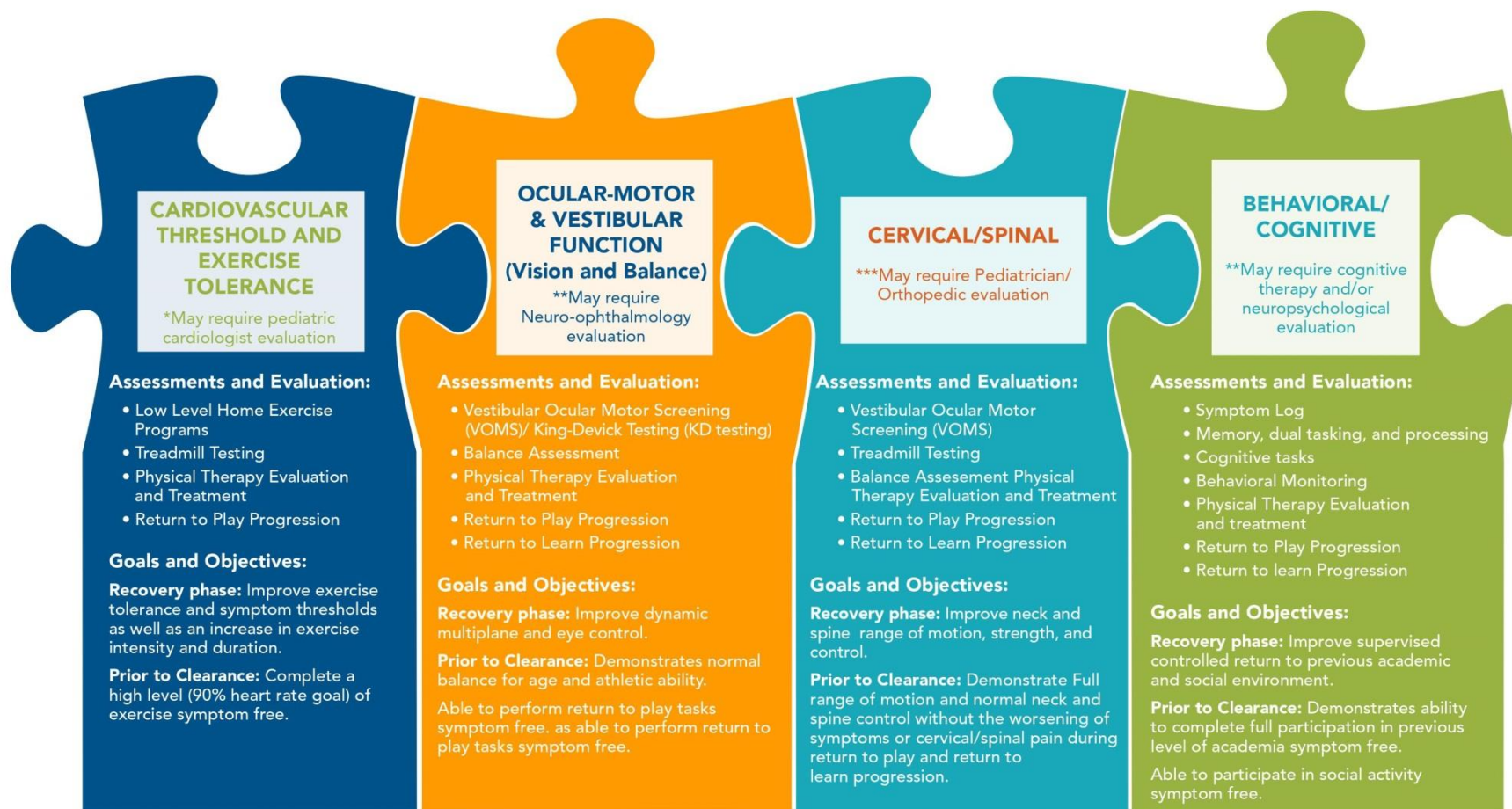
Berlin

- ▶ SRC may be caused either by a direct blow to the head, face, neck or elsewhere on the body with an **impulsive force** transmitted to the head.
- ▶ SRC typically results in the rapid onset of short-lived **impairment of neurological function** that resolves spontaneously.
 - ▶ SRC may result in neuropathological changes, but the acute clinical signs and symptoms largely reflect a **functional disturbance** rather than a structural injury.
 - ▶ SRC results in a range of clinical signs and symptoms that may or may not involve loss of consciousness.



Concussion Pillars for Recovery

ALL PILLAR GOALS MUST BE ACCOMPLISHED PRIOR TO CLEARANCE TO RETURN TO FULL ACADEMICS AND SPORT.



Matthew J. Morahan, III
Health Assessment Center for Athletes
RWJBarnabas Health

Barnabas Health
Ambulatory Care Center

RWJBarnabas
HEALTH

Let's be healthy together.

A Chemical Reaction

- Cerebral Blood Flow
- Autoregulation
- Autonomic Dysfunction
- Heart Rate Variability



How do you assess FUNCTION?



Cardiovascular Pillar-Active Brain Healing

What's new?

- Deconditioning the body post brain injury can slow recovery.
- Prolonged brain rest beyond 48 hours is controversial.

KEEP MOVING!!!!

Create a cross-disciplinary approach for academic and functional, and physical return.

- Acutely refer and Assess!
- Lost time means lost recovery!
- Quicker intervention with rehabilitation where needed for PCS patients.
- WHO'S ON YOUR TEAM?



Matthew J. Morahan, III
Health Assessment Center for Athletes

RWJBarnabas
HEALTH

Physiological Response to Exercise Following Concussion

Heart Rate Variability (HRV) In Sport: What It Is And How It Works

What Heart Rate Variability (HRV) Measures

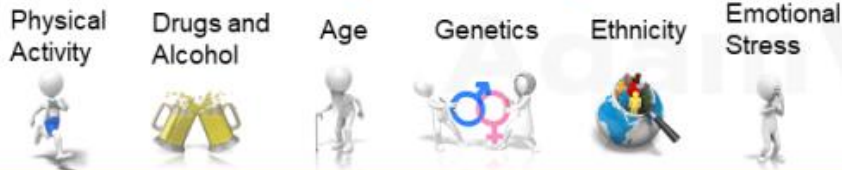
Heart Rate Variability (HRV) is the measure of **variance in time intervals between successive heartbeats** (i.e. cardiac cycles; R-R intervals)



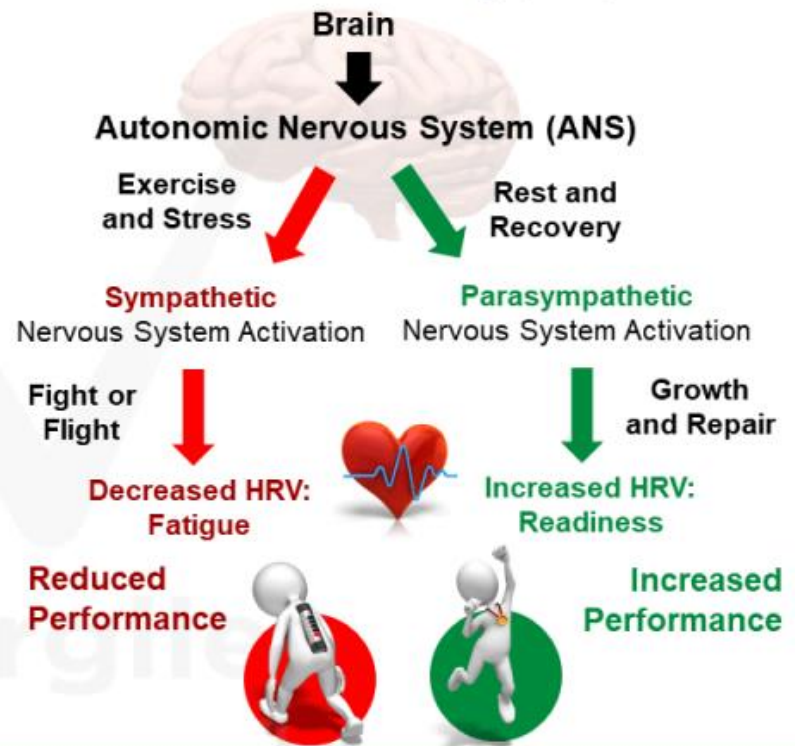
Use Of HRV To Monitor Athlete Training Stress

Heart Rate Variability (HRV) is a **valid and reliable predictor of Autonomic Nervous System (ANS) function**, which controls the sympathetic-parasympathetic balance of the body. This balance is altered in response to training stress; HRV could, potentially, be used to better understand the training adaptation and maladaptation in response to training stress

A Few Factors that Impact HRV Response Include



How Heart Rate Variability (HRV) Works



Created by Adam Virgile
adamvirgile.com

Social Media @AdamVirgile
@AVSportSci



Graphic References

Fattison, J., Oswald, V. and Lalonde, F., 2016. Influence diagram of physiological and environmental factors affecting heart rate variability: an extended literature overview. *Heart International*, 11(1), pp.heartint-5000232.



Matthew J. Morahan, III
Health Assessment Center for Athletes

RWJBarnabas
HEALTH

BLAST FROM THE PAST

OLD SCHOOL

- Cognitive rest/removal from school until symptom free (no graduated return)
- Prolonged symptomatology- “SIT AND WAIT MENTALITY”
- Impact test- highest weighted assessment
- No visual testing
- 100% asymptomatic before physical intervention

NEW SCHOOL

- 48 hours **complete** brain rest then gradual re-introduction of stimulus.
- Acute rehab intervention
- Ocular-motor/physiologic response- highest weighted assessment
- Visual testing from sideline through complete resolve
- Symptom threshold based intervention with pillar focus



Acute Diagnosis Decision Making

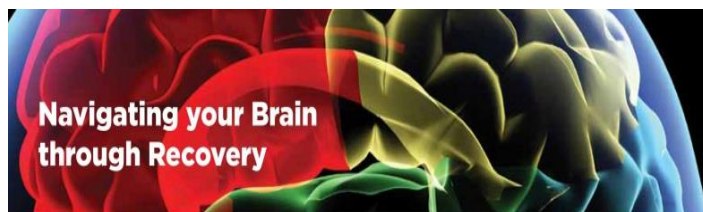
Subjective vs. Objective

- VOMS
- KD
- Scat 5/ Glasgow and Coma Scale
- C-spine

The eyes don't lie! Induce acutely. Don't wait!

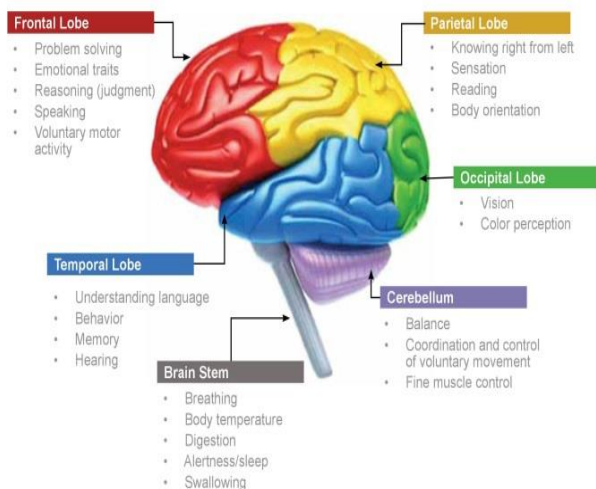


What's in your tool kit; Inducing vs Reducing Symptomatology



Navigating your Brain through Recovery

Without a true diagnostic tool, blood biomarker or special imaging (MRI, CT) that can diagnose concussion, clinicians have to rely on tools to assess different areas of the brain to determine any potential functions of the brain that can be compromised. Your brain supports every movement and major function in life including functions as crucial as the ability to breathe. Each lobe of the brain is responsible for different roles such as speech, reading, distinguishing between colors, balance, coordination, sleep, memory, behavior, and hearing. At the Morahan Center see how we are combating second impact syndrome by assessing every aspect of your brain.



Every brain heals at a different pace and over a different time span. Some brains can take weeks or months to heal, while others can experience long term symptoms that last years and even decades. The rate of recovery can be altered by psychological issues, Attention Deficit Hyperactivity Disorder (ADHD), gender, and other variable factors. Recovery is generally extended with every repeat injury or with a multiple concussion history as well as with patients or athletes that fail to report symptoms honestly or follow school accommodations or restrictions. It is very important to report symptoms honestly for this reason. Avoiding long term issues following a brain injury is largely dependent on ensuring the first concussion heals correctly. During a concussion one or several areas of the brain can be affected. Each area of the brain controls different functions for movement, motor skills, coordination, vision and daily function. Our colored brain map addresses each area of your brain and the ability to assess, track improvement, and map recovery of every brain injury with an individualized plan of care.

Areas of the Brain Testing Targets	Testing Type	Appropriate Ages	Testing Facts
Frontal Lobe	King-Devick Testing	5 and up	50% of the brain's pathways are tied to vision. Following a suspected brain injury, the King-Devick (KD) Test tracks Saccadic Eye Movements and asks participants to read numbers from left to right. Baseline testing prior to an injury, includes several timed trials measuring eye speed as the participant verbalizes numbers aloud. The total time of all three cards (cards two through 4) without errors becomes the participant's baseline. Significant delay in eye movement speed and an increase in errors recorded is a significant change that can be found post-concussion when compared to baseline. This deficit may be detected in the acute phase following a suspected Brain Injury. The KD can also assess difficulty reading or with screen use following a concussion.
Occipital Lobe			
Parietal Lobe			
Cerebellum			
Frontal Lobe	ImPACT Testing	5 and up	ImPACT (Immediate Post Concussion Assessment and Cognitive Testing) is an interactively administered computerized exam. This software program was developed by The University of Pittsburgh Medical Center's (UPMC) Sports Concussion program. It challenges the brain and tracks information such as memory, reaction time, processing speed, and concentration. A baseline, pre-injury ImPACT test is recommended every two years. If the athlete later suffers a brain injury, she/he can then retake this test. Any changes since the baseline test was taken may help determine the severity of the injury and the pace at which it is healing.
Occipital Lobe			
Temporal Lobe			
Cerebellum	Vestibular Ocular Motor Screening (VOMS)	10 and up	Ocular-Motor dysfunction occurs when muscles in the eye are not properly coordinated for eye movement. This dysfunction is common following concussion and can be a large contributing cause to visual disturbances during recovery and frequent headaches or symptoms. The VOMS can assess if ocular-motor dysfunction exists as well as issues with balance or vestibular issues. It is completed by a clinician or physician in both the baseline and post-concussion setting to help assist the clinical team in returning deficits back to normal prior to returning to the field. This issue can effect hand and eye coordination in sports as well as concentration and reading in school.
Occipital Lobe			
Frontal Lobe	Treadmill Testing	10 and up	Treadmill testing is a valuable tool for clinicians to determine physical function sooner after an injury. A child that becomes symptom free more quickly can be taken through a basic treadmill test to see if they are eligible for the Return to Play protocol to begin. This becomes especially important for children that do not have an ImPACT baseline to compare to or for children that struggle with successfully completing neuro-cognitive tests. Treadmill testing is also valuable in determining exercise tolerance as well as determining whether the body's response to exercise is normal when a child is still experiencing symptoms. Symptomatic treadmill testing is a significant help to our physical therapy team in determining an appropriate plan of care and gradual return to sports.
Cerebellum			
Brain Stem			



YOUR ATR Concussion Kit



1 Tennis ball- \$1.99
6 colored Cones- \$5.99
Measuring tape- 1.75
1 Tounge Depressor- .30
1 Polar watch- 69.99

Grand Total - \$80.02



Matthew J. Morahan, III
Health Assessment Center for Athletes

RWJBarnabas
HEALTH

BERLIN ON BRAINS

5TH INTERNATIONAL CONCUSSION CONFERENCE IN SPORT (Berlin)

Newest changes

- Complete cognitive rest not validated after 48 hours
- Symptom threshold through activity/cognition in acute phase
- Focus on categories for recovery (ocular-motor/cognitive/exercise threshold/cervical)
- Defining PCS in children (>4 weeks with symptoms)

****Having a low level of a person's initial symptoms in the first day or initial few days after injury is a favorable prognostic indicator.**

**** Children with a pre-injury history of mental health problems or migraines appear to be at somewhat greater risk of having symptoms >1 month**

**** ADHD- challenging intervention with return to school**



LEDDY LEADS THE CHARGE (University of Buffalo)

Sports Related Concussion(SRC)

- 7-10 days typical for recovery (may be delayed in children/adolescents)
- Recent research accounts for Vestibular-ocular/motor problems that often accompany SRC suggests recovery for adolescents may take 3-4 weeks.

Are you up for the challenge?

- Concussion or secondary factor (Migraines, Cervical injury, depression).
- Assess pillars in depth; take solid medical history.
- SLOWER EXERCISE TOLERANCE=SLOWER RECOVERY



LEDDY LEADS THE CHARGE (University of Buffalo)

The scoop on CBF

- Cerebral blood flow increases during exercise
- Following concussion we typically see a loss of CBF control
- With deconditioning we also see a natural loss of control with CBF causing fatigue, slowed cognition, symptoms, inability to exercise to max capacity and abnormal elevations in CBF; negative effect on autoregulation.

How do we improve CBF?

- Exercise can improve CBF by calculating 80%-90% of symptom threshold or by increasing THR 5-10 bpm every 1-2 weeks.
- SLOWER EXERCISE TOLERANCE=SLOWER RECOVERY

New methods

Activate autonomic NS early on and try to help restore CBF through early activity such as low level movements to maintain conditioning (light walking, jogging, biking). Avoid weight training till final stages of RTP.

Berlin states, “closely monitored active rehabilitation programs involving controlled sub-symptom threshold, submaximal exercise have been shown to be safe and may be of benefit in facilitating recovery.”

SO HOW MUCH IS TOO MUCH?



Matthew J. Morahan, III
Health Assessment Center for Athletes

RWJBarnabas
HEALTH

Pillar #1 Cardiovascular

- Exercise Tolerance Testing
 - 2 minutes between stages
 - Capture RPE
 - Progressive increase in speed and incline
 - THINK: desired HR
 - RTP: 70%, 80%, 90% resting HR reserve (HRR)

Rating of Perceived Exertion Borg RPE Scale			
6	Very, very light	How you feel when lying in bed or sitting in a chair relaxed. Little or no effort.	
7			
8			
9			
10	Fairly light	Target range: How you should feel with exercise or activity.	
11			
12	Somewhat hard		
13			
14	Hard	How you felt with the hardest work you have ever done.	
15			
16			
17	Very hard		Don't work this hard!
18	Very, very hard		
19			
20	Maximum exertion		



Pillar #1 Cardiovascular

Clinical Pearls

- Some patients will greatly improve when pushed.
- BE VERY AWARE some will Crash.
 - If symptoms increase > 2 levels stop the task (NCAA level athletes can be pushed 3 points).
- Rehabilitation focuses on dual tasking with TM tests as the pillar progresses.
- Typically in active recovery- A large percentage of initial evals will pass TM testing with no symptom change during the acute phase.
- Bike protocol option (All thresholds should always be assessed upon initial evaluation).



Bike Protocol



BCTT Output Conversion - Microsoft Excel

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1	Stage (%grade)	VO2	METS	BW (KG)	Workload (Watts)													
2		0	13.1	3.74	46.5186													
3		1	14.83	4.24	59.71158													
4		2	16.56	4.73	72.90456													
5		3	18.28	5.22	86.02128													
6		4	20.01	5.72	99.21426													
7		5	21.74	6.21	112.40724													
8		6	23.47	6.71	125.60022													
9		7	25.2	7.2	138.7932													
10		8	26.92	7.69	151.90992													
11		9	28.67	8.19	165.25542													
12		10	30.38	8.68	178.29588													
13		11	32.12	9.17	191.56512													
14		12	33.85	9.67	204.7581													
15		13	35.56	10.16	217.79856													
16		14	37.92	10.65	235.79592													
17		15	39.03	11.15	244.26078													
18																		
19																		
20																		
21																		
22																		
23																		
24																		
25																		
26																		
27																		
28																		
29																		
30																		
31																		
32																		
33																		
34																		
35																		
36																		
37																		
38																		
39																		
40																		

Sheet1 Sheet2 Sheet3

Ready

100%

10:46 AM 4/6/2018



Karvonen Review

Age Predicted Maximum Heart Rate (APMHR) $220 - \text{Age} = \text{APMHR}$

$\text{MHR} \times \% \text{ intensity} = \text{Target Heart Rate (THR)}$

RTP Stage II Sample

Example: 16 year old at 70% intensity

$$220 - 16 = 204$$

$$204 \times 0.70 = 143 \text{ bpm}$$

Karvonen Formula - Heart Rate Reserve (HRR) $220 - \text{Age} = \text{MHR}$

$\text{MHR} - \text{Resting Heart Rate} = \text{HRR}$

$(\text{HRR} \times \% \text{ intensity}) + \text{RHR}$

RTP Stage II Karvonen Review

THR Example: 16 year old,

resting heart rate = 62 bpm, at 70% intensity

$$220 - 16 = 204$$

$$204 - 62 = 142$$

$$142 \times 0.70 = 99 + 62 = 161 \text{ bpm}$$

Why Karvonen? One of the problems with the APMHR equation is that it makes no allowances for individual differences in resting heart rate. By incorporating the heart rate reserve into the equation, in theory a more accurate training zone can be determined.





Name: _____

DOB: _____

Active Recovery Plan

Exercise Log: This daily at home exercise log is a tool that can help fast track your recovery for Return to Play (RTP). Please identify which cardiovascular activity (Walking, Treadmill, Stationary Bike) you participated in below each day. Please rate any symptoms you may have during your workout (1-2: Mild, 3-4: Moderate, 5-6: Severe) based on symptom key at the bottom of this page. **STOP ANYTIME YOUR SYMPTOMS CHANGE OR INCREASE.**

Activity: _____	Borg Rating of Perceived Exertion 6 No exertion at all 7 8 Extremely light 9 Very Light 10 11 Light 12 13 Somewhat hard 14 15 Hard (heavy) 16 17 Very Hard 18 19 Extremely hard 20 Maximal exertion
Duration: _____	
Times a day: _____	
Additional comments: _____ _____	

1 Workout	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5	DAY 6	DAY 7
Date: _____	Date: _____	Date: _____	Date: _____	Date: _____	Date: _____	Date: _____	Date: _____
Activity							
Duration/Time							
RPE							
Symptoms							
2 Workout	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5	DAY 6	DAY 7
Date: _____	Date: _____	Date: _____	Date: _____	Date: _____	Date: _____	Date: _____	Date: _____
Activity							
Duration/Time							
RPE							
Symptoms							

Physical	Cognitive	Emotional	Sleep
(H)Headache, (N)Nausea, (V)Vomiting, (B)Balance Problems, (D) Dizziness, (VP)Visual Problems, (F)Fatigue, (SL)Sensitivity to light & (SN)Noise, (NT)Numbness/Tingling	(MF)Mentally Foggy,(SD)Slowed Down, (DC)Difficulty Concentrating, (DR)Difficulty Remembering	(I)Irritability, (S) Sadness, (NE)Nervousness, (E) Emotional (More than usual)	(DR) Drowsiness, (SLU)Sleeping Less Than Usual, (SMU)Sleeping More Than Usual, (TFA)Trouble Falling Asleep

****IF ATHLETE BEGINS TO VOMIT OR REPORTS AN INCREASED HEADACHE OR SYMPTOMS CONTINUE TO WORSEN, OR IF YOU HAVE ANY URGENT CONCERNS ABOUT THE ATHLETE'S CONDITION PLEASE REPORT TO THE CLOSEST EMERGENCY ROOM AND ALSO CALL THE MJM CENTER at 973-322-7913****

Athlete Signature: _____

Parent Signature: _____

Date : _____

Pillar # 2 Ocular Motor and Vestibular Function

- Vision, Balance, Coordination
 - **Ability to sense, predict and prevent multi-planer movement (Linear, Angular/Rotational, Velocity, Gravitational)**
 - Balance assessments
 - Baseline Vision



Pillar # 2 Ocular Motor and Vestibular Function

- Remember: The Vision system drives function
 - Primary complaints:
 - Head aches all day
 - Blurred vision
 - Double vision
 - Photophobia
 - Eye fatigue
 - Dizziness / Vertigo
 - #1 Trouble with Screens/ School/ Reading
 - Headaches/Dizziness are two key symptoms most frequently reported upon initial injury that we are finding in studies (A high volume correlate with ocular motor dysfunction)



Pillar # 2 Ocular Motor and Vestibular Function

- VOMS
 - Pursuit, Saccades, VOR, Convergence/ Divergence
- Accommodation
- Dynamic Visual Acuity
- Saccadic Head Turns
- Ocular Misalignment



VOMS

VESTIBULAR OCULAR MOTOR SCREENING

- Assessment to help determine neurological dysfunction
- Symptom score of 0-10
- Baseline scoring in the office completed just prior to administration of the VOMS and after each module is completed.
- Any change pre to post after completing the modules may indicate signs of concussion.
- 30 Reps VOR= 5 mins. reading

****Endorsed and validated by UPMC**

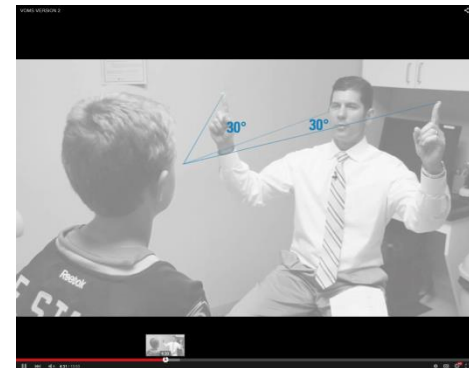
*****Validated for non-healthy controls and healthy controls**

VOMS VERSION 2

Press Esc to exit full screen mode.

Vestibular/Ocular Motor Test	Not Tested	Headache Rated 0-10	Dizziness Rated 0-10	Nausea Rated 0-10	Fogginess Rated 0-10	Comments
Baseline (Pre-VOMS) Symptoms						
Smooth Pursuits						
Saccades - Horizontal						
Saccades - Vertical						
Convergence (Near Point)						Near Point (cm):
VOR - Horizontal						
VOR - Vertical						
Visual Motor Sensitivity Test						

1:33 / 13:53



Matthew J. Morahan, III
Health Assessment Center for Athletes

RWJBarnabas
HEALTH

A Brief Vestibular/Ocular Motor Screening (VOMS) Assessment to Evaluate Concussions (American Journal Of Sports Medicine)

- 2014 study
- Sixty-four patients, aged 13.9 ± 2.5 years and seen approximately 5.5 ± 4.0 days after a sport-related concussion
- Sixty-one percent of patients reported symptom provocation after at least 1 VOMS item.
- All VOMS items were positively correlated to the PCSS total symptom score.
- ***The VOR and VMS components of the VOMS were most predictive of being in the concussed group.***
- An NPC distance ≥ 5 cm and any VOMS item symptom score ≥ 2 resulted in an increase in the probability of correctly identifying concussed patients of 38% and 50%, respectively.

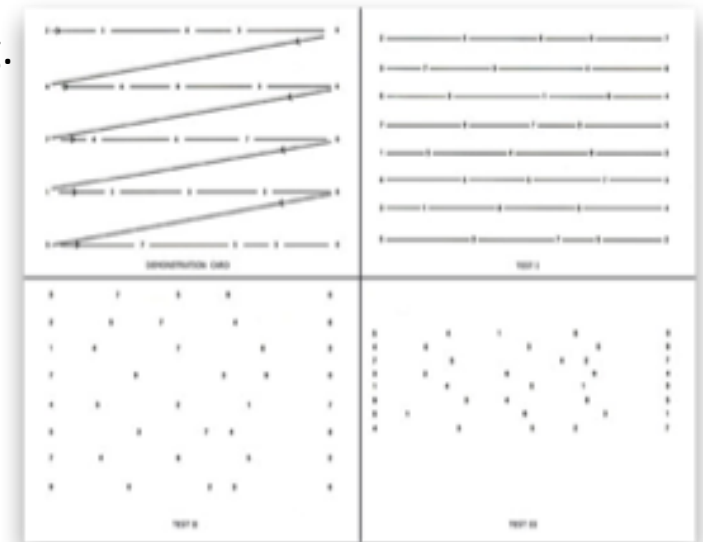
Why do VOMS on the sideline??



Assessments at the Forefront: King Devick Test

50% of the brain's pathways are tied to vision

- Sideline assessment or tool to assess suspicion of concussion. Recommended within the first 24 hours of impact.
- Measurement on the speed of rapid number naming.
 - *Timed test for reading single digit numbers on a card from left to right.*
- Evaluate eye movement, attention, and language to assess the baseline brain function, allowing the ability to predict worse outcomes in concussion.
- Baseline obtained; repeat testing done on sideline after injury to determine if a deficit exists at time of injury.
- Method of baseline for younger subjects
- Demo testing



Pillar # 3

Cervical/Spinal

- **Whiplash/ Cervical strain**
- Indications
 - Aberrant cervical movement with oculomotor, or cervical screen
 - Constant Headaches
 - ***Reproducible*** Cervicogenic Headaches
 - Significant changes in balance with static head positions
 - Postural abnormalities or weakness
 - Abnormal Saccadic accuracy
 - If cervical issue is present, this pillar is often addressed first prior to others.
 - Rarer in diagnosis



Pillar # 4 Behavioral/ Cognitive

- NEW idea
 - Flight or flight response to injury
 - Stress/Anxiety/Panic loop
 - Parental or Social cause
- Sports Confidence/Mental Health
- Primary Symptoms
 - Severe symptoms that do not vary
 - Unable to elicit predictable symptoms within the other pillars.
 - Unable to induce symptoms with correlated tasks within other pillars.



Pillar # 4 Behavioral/ Cognitive

- Clinical pearls
 - Physiologic quieting
 - Low stimulation environment
 - Deep pressure
 - Meditation
 - Manual Therapy
- Refer
 - May require assistance from Behavioral Psychology and/or Sports Psychology.
 - Sports Confidence



PILLAR POINTS

WHEN IN DOUBT REFER OUT!!!

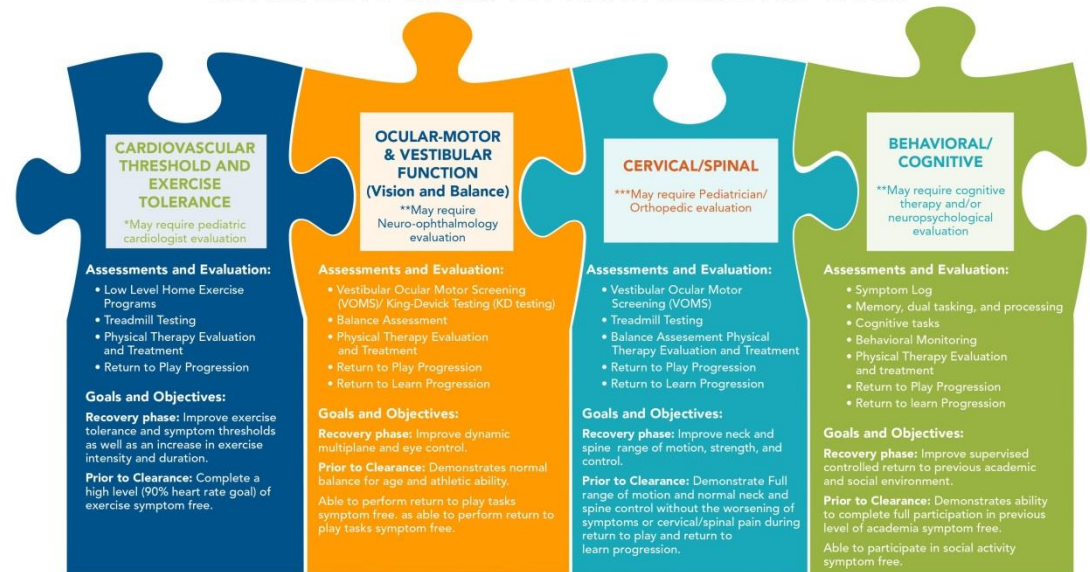
- Neuropsychologist
- Cardiovascular- Pediatric Cardiologist
- Ocular/Motor- Neuro-ophthamologist
- Cervical- Ortho (Spine)
- Behavioral/Cognitive- Cognitive therapist and/or Mental Health provider

*** Patient must pass all pillars prior to progressing to full contact practice and game play

Have strong cross referral partnerships!

Concussion Pillars for Recovery

ALL PILLAR GOALS MUST BE ACCOMPLISHED PRIOR TO CLEARANCE TO RETURN TO FULL ACADEMICS AND SPORT.



Matthew J. Morahan, III
Health Assessment Center for Athletes
RWJBarnabas Health

Barnabas Health
Ambulatory Care Center

RWJBarnabas
HEALTH
Let's be healthy together.

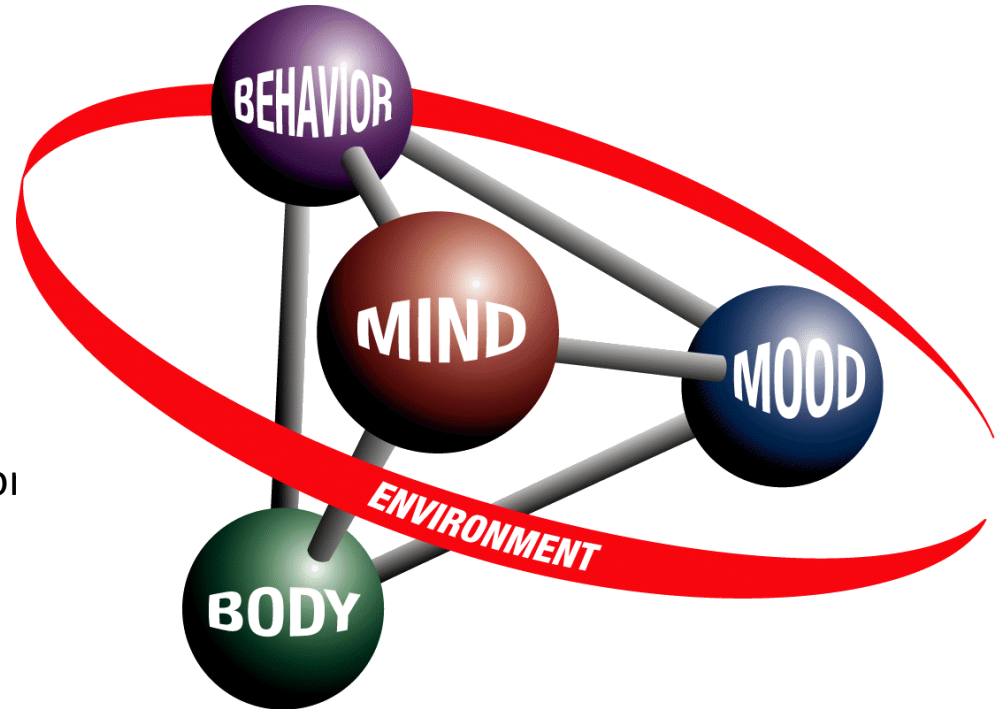


Matthew J. Morahan, III
Health Assessment Center for Athletes

RWJBarnabas
HEALTH

Return to Learn before Return to Play

- Academic restrictions
- Graded activities
 - I.e. VOR > 30 reps = 5 minutes of reading.
- Cognitive Duel tasking
 - DURING ALL (PCS Rehab) tasks.
- Cognitive Therapy
 - If symptoms do not resolve within > 2 months PT
 - Or if stimulation/concentration is primary limiting factor.



RTL Before RTP- how do we gradually re-introduce?

****Parent and child/athlete **accountability**- Must have for effectiveness.



Name: _____



Matthew J. Morahan, III
Health Assessment Center for Athletes
RWJBarnabas Health

Today's Date: _____

Patient Instructions: This daily symptom log is a tool that can be used to track your symptoms throughout recovery. Please identify (using the key below) & rate any symptom you have during your class (1-2: Mild, 3-4: Moderate, 5-6: Severe). Also include what activity (ie: reading, algebra, computer) that you were doing and how long it lasted

	EXAMPLE Class: <u>Math</u> Duration: <u>45</u> <u>minutes</u>	1 st Period Class: _____ Duration: _____	2 nd Period Class: _____ Duration: _____	3 rd Period Class: _____ Duration: _____	4 th Period Class: _____ Duration: _____	5 th Period Class: _____ Duration: _____	6 th Period Class: _____ Duration: _____	7 th Period Class: _____ Duration: _____	8 th Period Class: _____ Duration: _____
Cognitive work during class/ activity that caused symptoms	Smart Board use MacBook Use								
List Symptoms (using below abbreviations) during class & Rate (1-6)	H- 5 N- 3 SL- 2								
How long did the symptom(s) last?	H- 2 hours N- 30 minutes SL- 2 hours								
What did you do to reduce the symptom?	Left class 20 minutes early and rested at nurses office.								

Symptoms of a concussion:

Physical	Cognitive	Emotional	Sleep
(H)Headache, (N)Nausea, (V)Vomiting, (B)Balance Problems, (D) Dizziness, (VP)Visual Problems, (F)Fatigue, (SL)Sensitivity to light & (SN)Noise, (NT)Numbness/Tingling	(MF)Mentally Foggy,(SD)Slowed Down, (DC)Difficulty Concentrating, (DR)Difficulty Remembering	(I)Irritability, (S) Sadness, (NE)Nervousness, (E) Emotional (More than usual)	(DR) Drowsiness, (SLU)Sleeping Less Than Usual, (SMU)Sleeping More Than Usual, (TFA)Trouble Falling Asleep

Return to Play – What's your RTP POC

- **Stage 1**
 - no symptoms (age dependent), 100% academia (48 hours full school and cognitive tasks within the asymptomatic week) ACTIVE RECOVERY (progress RTL/ Social)
- **Stage 2 (Recovery Zone)**
 - TM test \leq 70% HR, basic balance, oculomotor, sport movements
- **Stage 3 (Aerobic Zone)**
 - 80% HRR, sport movements, cone drills, cognitive dual tasking
- **Stage 4 (Anaerobic Zone)**
 - 90% + HRR, max effort, all sport specific tasks/High Intensity.
- **Stage 5**
 - Return to supervised sports
- **Stage 6**
 - Return to competition

Consider Antidepressant therapy, multiple concussion history. VOMS?

*****Vitals are a MUST!**

Matthew J. Morahan, III
Health Assessment Center for Athletes



1 Graduated return-to-sport (RTS) strategy

Stage Aim Activity Goal of each step 1

Symptom-limited activity Daily activities that do not provoke symptoms Gradual reintroduction of work/school activities

2 Light aerobic exercise Walking or stationary cycling at slow to medium pace. No resistance training Increase heart rate

3 Sport-specific exercise Running or skating drills. No head impact activities Add movement

4 Non-contact training drills Harder training drills, eg, passing drills. May start progressive resistance training Exercise, coordination and increased thinking

5 Full contact practice Following medical clearance, participate in normal training activities Restore confidence and assess functional skills by coaching staff

6 Return to sport Normal game play

**RWJBarnabas
HEALTH**

Thank you!



Matthew J. Morahan, III
Health Assessment Center for Athletes
RWJBarnabas Health

973-322-7913

RWJBarnabas
HEALTH



Matthew J. Morahan, III
Health Assessment Center for Athletes

RWJBarnabas
HEALTH