Educational Concussion Overview

CONCUSSION MANAGEMENT IS AT THE FOREFRONT

WITH RWJBARNABAS HEALTH AND THE MATTHEW J. MORAHAN III HEALTH ASSESSMENT CENTER FOR ATHLETES

See how we're keeping your brain in the game!

Offering one of the most comprehensive pre-season screening and concussion management centers in the State of New Jersey, the Morahan Center has provided pre-season cardiac and concussion testing to over 40,000 of New Jersey's athletes since 2010.

RWJBarnabas Health is taking the lead on Acute Concussion

According to the CDC, 300,000 concussions occur as a result of sports-related injury annually. At RWJBarnabas Health and the Matthew J. Morahan III Health Assessment Center for Athletes, a multidisciplinary approach using top experts in their field, provides athletes with the best approach to a safe recovery.

Concussion by definition means to shake violently. A concussion can occur from any blow to the head, neck, jaw, face, or body that forcibly moves the brain within the skull. Second Impact Syndrome (SIS) is defined as experiencing two concussions within a short period of time. Second Impact syndrome can lead to severe and prolonged symptoms, brainstem herniation, and in rare cases death. Accurate symptom assessment, reporting, and excellent clinical monitoring and management is key to prevention of SIS.

Symptoms of Concussion

- Headache
- Nausea
- Vomiting
- Memory loss
- Dizziness
- Feeling slow
- Sensitivity to light or noise
- Blurred or double vision
- Heavy head or "mentally foggy"
- Irritability or mood changes
- Sleep difficulties
- Fatigue or exhaustion
- Sleeping more or less than usual
- Inability to concentrate or focus

Additional Educational Patient Resources

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

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Acute Brain Injury Management Education

Activity	Activity at Each Step
Cognitive daily activities that do not result in more than a mild exacerbation of symptoms related to the current concussion	Typical activities during the day (for example, reading) while minimizing screen time. Start with 5-15 minutes at a time and increase gradually, one time per day.
School or work activities	As prescribed by Morahan Center Team.
Active recovery	Daily walking (20 minutes) on flat ground. Avoid risk of contact to head/body.

Relative Rest

Current evidence indicates that complete rest following concussion in the first few days is no longer beneficial. Relative rest is defined as including activities of daily living and reduced screen time during recovery. It applies to the first 24 to 48 hours immediately following an acute brain injury. Recommendations include decreasing screen brightness and/or the use of blue light and increasing font size. The amount of activity following this period will be modified and prescribed at the pace of the individual following evaluation and treatment from the Morahan Center Team.

Mild Symptoms

Mild symptoms for both cognitive and physical activities means that symptoms do no increase more than 2 points on a 0 to 10 scale from the baseline and/or do not last for more than one hour following the activity.

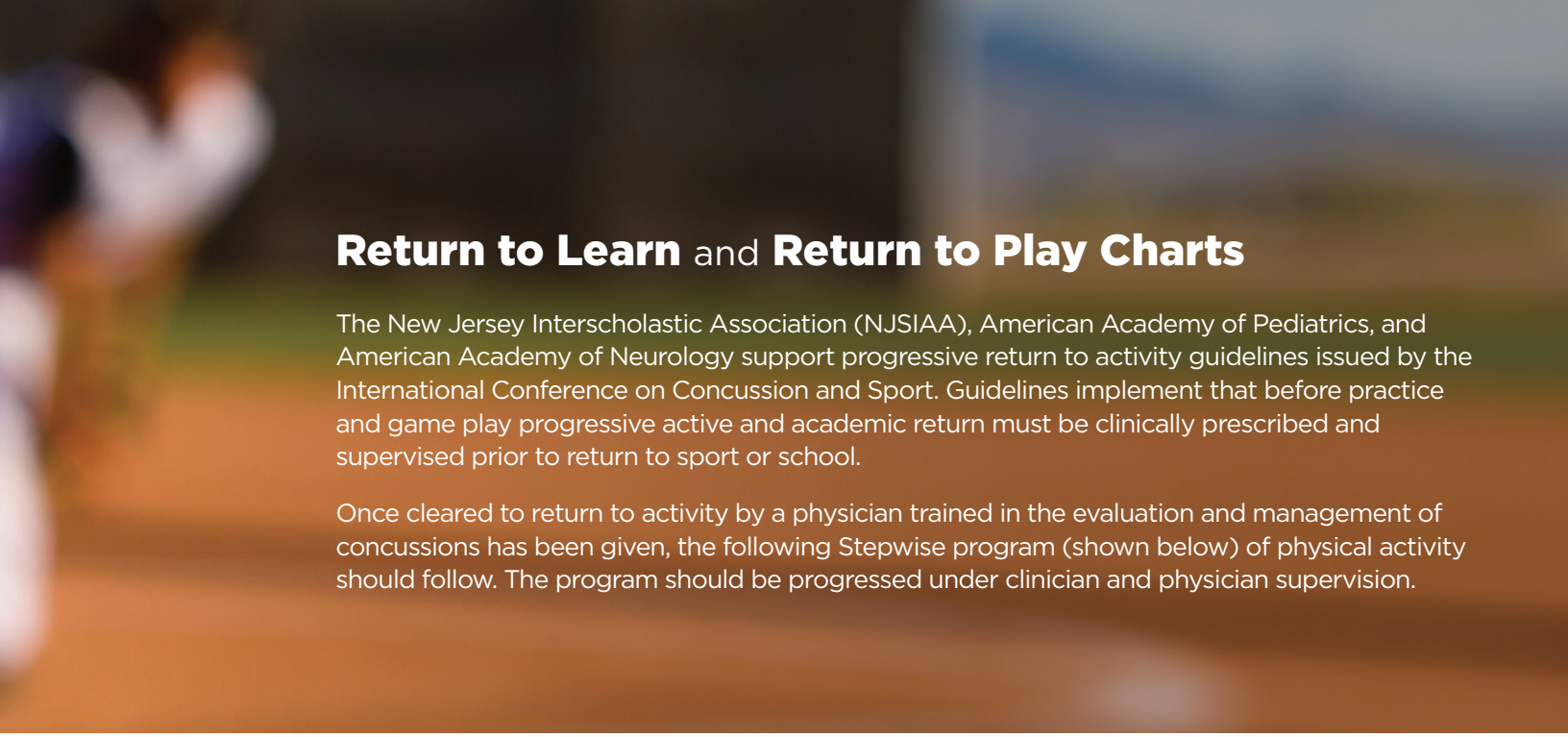
Combating Second Impact Syndrome

Return to LEARN

Here is a sample of the "Return to Learn" progression supported by the University of Buffalo Concussion Clinic.

Stage	Activity	Objective
No activity	Complete cognitive rest – no school, homework, reading, texting, video games, or computer work	Recovery
Gradual reintroduction of cognitive activity	Relax previous restrictions on activities and add short periods of cognitive activities (5-15 minutes at a time)	Gradual controlled increase in sub-symptom threshold cognitive activities
Homework at home before school work at school	Homework in longer increments (20-30 minutes at time)	Increase cognitive stamina by repetition of short periods of self-paced cognitive activity
School re-entry	Part day of school after tolerating 1-2 cumulative hours of homework at home	Re-entry into school with accommodations to permit controlled sub-symptom threshold increase in cognitive load
Gradual reintegration into school	Increase to full day of school	Accommodations decrease as cognitive stamina improves
Resumption of full cognitive workload	Introduce testing, catch up with essential work	Full return to school; may commence Return-To-Play protocols when symptom free

Any worsening or increased frequency of symptoms should be reported to the doctor managing each patient's concussion. ***TIP: Keep a log of symptoms that your child reports after a school day and what activities they were doing when symptoms occurred.***



Return to Learn and **Return to Play Charts**

The New Jersey Interscholastic Association (NJSIAA), American Academy of Pediatrics, and American Academy of Neurology support progressive return to activity guidelines issued by the International Conference on Concussion and Sport. Guidelines implement that before practice and game play progressive active and academic return must be clinically prescribed and supervised prior to return to sport or school.

Once cleared to return to activity by a physician trained in the evaluation and management of concussions has been given, the following Stepwise program (shown below) of physical activity should follow. The program should be progressed under clinician and physician supervision.

Return to PLAY

The following, current Return to Play (RTP) guidelines are from the Consensus Statement on Concussion in Sport, presented at the 6th International Conference on Concussion in Sport (Amsterdam, October 2022).

Step	Exercise Strategy	Activity at each step	Goal
1	Symptom-limited activity	Daily activities that do not exacerbate symptoms (e.g., walking).	Gradual reintroduction of work/school
2	**Aerobic exercise** 2A – Light (up to approximately 55% max hear rate) then 2B – Moderate (up to approximately 70% max heart rate)	Stationary cycling or walking at slow to medium pace. May start light resistance training that does not result in more than mild and brief exacerbation* of concussion symptoms.	Increase heart rate
3	Individual sport-specific exercise Note: If sport-specific training involves any risk of inadvertent head impact, medical clearance should occur prior to Step 3	Sport-specific training away from the team environment (e.g., running, change of direction and/or individual training drills away from the team environment). No activities at risk of head impact.	Add movement, change of direction
Steps 4-6 should begin after the resolution of any symptoms, abnormalities in cognitive function and any other clinical findings related to the current concussion, including with and after physical exertion.			
4	Non-contact training drills	Exercise to high intensity including more challenging training drills (e.g., passing drills, multiplayer training) can integrate into a team environment.	Resume usual intensity of exercise, coordination and increased thinking
5	Full contact practice	Participate in normal training activities.	Restore confidence and assess functional
6	Return to sport	Normal game play	

Any onset of symptoms with exercise should be reported to the doctor managing each patient's concussion.

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.

Frontal Lobe

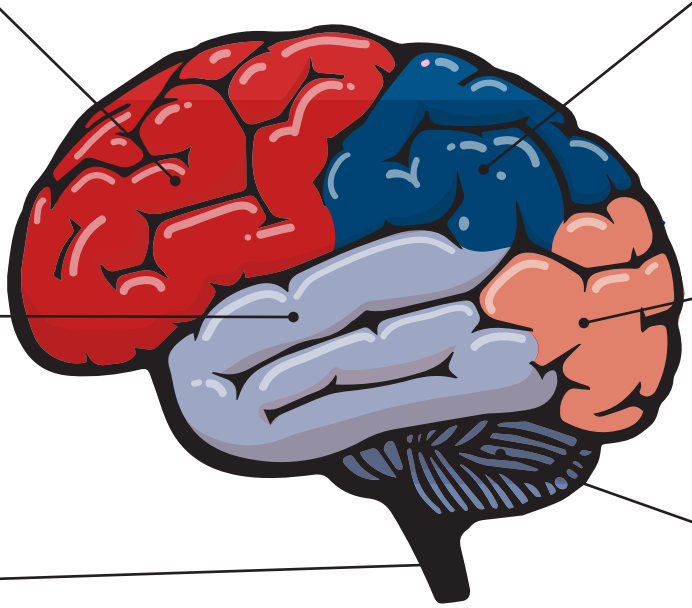
- Problem solving
- Emotional traits
- Reasoning (judgment)
- Speaking
- Voluntary motor activity

Temporal Lobe

- Understanding language
- Behavior
- Memory
- Hearing

Brain Stem

- Breathing
- Body temperature
- Digestion
- Alertness/sleep
- Swallowing



Parietal Lobe

- Knowing right from left
- Sensation
- Reading
- Body orientation

Occipital Lobe

- Vision
- Color perception

Cerebellum

- Balance
- Coordination and control of voluntary movement
- Fine muscle control

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. Extended recovery timelines can occur with subsequent concussions as well as failure to report symptoms or comply with management plans. 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. Evaluating function in each lobe of the brain can address its ability to process and recall information as well as understand recovery rates of the brain as it responds to stimulus.

Target Testing Zones of the Brain and Spine	Testing Type	Appropriate Ages	Testing Facts
Frontal Lobe **Occupital Lobe** **Parietal Lobe** **Cerebellum**	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.
Frontal Lobe **Occupital Lobe** **Temporal 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.
Cerebellum **Occupital Lobe**	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 affect hand and eye coordination in sports as well as concentration and reading in school.
Frontal Lobe **Cerebellum** **Brain Stem**	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 team in determining an appropriate plan of care and gradual return to sports.

Ergonomics at School

Ergonomics is the science of improving a student's efficiency at school through internal and external modifications in order for them to succeed in an optimal learning environment. After a concussion, a student may experience difficulties at school due to their concussion-related symptoms. Poor posture, bright light and screens, visual issues, and heavy backpacks can aggravate these symptoms. The following are helpful tips for students, which outline the proper utilization of ergonomics at school and may aide in their concussion recovery.

Please note: *If you are experiencing any ergonomic challenges that are impacting your symptoms or performance in school, please speak up and notify the clinical concussion team so academic accommodations can be made.*

Lights/ Screens	• Children spend hours a day looking at different screens such as computers, televisions, smartphones, and smart boards. Total screen use can lead to eye discomfort, headaches, and pain. • Fluorescent lighting is common in most classrooms and can cause sensitivities, behavior problems, and learning difficulties. The possibility of LED lights, increased exposure to natural light, or temporary sunglasses/hat wear could be beneficial to reduce problems. • Lower the brightness or adjust to "night-mode" when working on computers or smartphones to prevent further eyestrain. **Please reduce amount of screen use and adjust exposure to irritant lighting if sensitive.**
Vision	• School is visually demanding and requires intense concentration through focused attention, daily reading and note-taking, and constant peer-to-peer interaction. Be sure to have the appropriate corrective lenses and a comfortable visual line of sight/unobstructed view when sitting in class as the eyes need to see clearly in order to recover. • Computer Vision Syndrome describes eye strain and vision problems due to excessive computer use. Reduced attention and self-awareness may also occur. Implement break times and limit distance to no less than 2 feet from the screen. **Please update your eye prescription or schedule an eye examination to ensure normal visual acuity and prevent difficulties with academics/reading.**
Posture	• **Head:** Keep head centered towards the board or teacher to limit neck strain and adjust position in class, if needed. Keep eyes leveled with the computer monitor by adjusting chair, desk, or screen. • **Arms:** Keep the shoulders relaxed, forearms parallel to the floor, and wrist neutral on keyboard. • **Back:** Keep in contact with the back of the chair to promote upright posture. Shift the chair forward instead of leaning your body into the desk. • **Legs:** The chair should support the thighs and the legs should ideally bend at a 90° angle. • **Duration:** Prolong impaired posture in sitting or with smartphone use can lead to furthermusculoskeletal issues. **Please modify workspace and correct posture to limit inactivity and injury.**
Backpack Safety	• Heavy backpacks can be harmful to the curvature of the spine leading to impaired posture, musculoskeletal injury/ pain, and balance issues. • Students should only carry backpacks that are no more than 10-15% of their body weight. • Ensure backpacks have two shoulder pads/waist straps and wear both securely at all times. • Keep heavier items in the center to maintain balance when walking. **Please adjust backpack and class schedule to limit heavy loads throughout the day.**

Concussion Pillars for Recovery

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

CARDIOVASCULAR THRESHOLD & EXERCISE TOLERANCE

*May require pediatric cardiologist evaluation

Assessments & Evaluation:

- Low Level Home Exercise Programs
- Treadmill Testing
- Physical Therapy Evaluation and Treatment
- Return to Play Progression

Goals and Objectives

Recovery phase:
Improve exercise tolerance and symptom thresholds as well as an increase in exercise intensity and duration.

Prior to Clearance:
Complete a high level (90% heart rate goal) of exercise symptom free.

OCULAR-MOTOR & VESTIBULAR FUNCTION (Vision and Balance)

**May require neuro-ophthalmology evaluation

Assessments & Evaluation:

- Vestibular Ocular Motor Screening (VOMS)/ King-Devick Testing (KD testing)
- Balance Assessment
- Physical Therapy Evaluation and Treatment
- Return to Play Progression
- Return to Learn Progression

Goals and Objectives

Recovery phase:
Improve dynamic multiplane and eye control.

Prior to Clearance:
Demonstrates normal balance for age and athletic ability.

Able to perform return to play tasks symptom free. as able to perform return to play tasks symptom free.

CERVICAL/SPINAL

***May require pediatrician/ orthopedic evaluation

Assessments & Evaluation:

- Vestibular Ocular Motor Screening (VOMS)
- Treadmill Testing
- Joint Position Error (JPE) Testing
- Balance Assessment Physical Therapy Evaluation and Treatment
- Return to Play Progression
- Return to Learn Progression

Goals and Objectives

Recovery phase:
Improve neck and spine range of motion, strength, and control.

Prior to Clearance:
Demonstrate Full range of motion and normal neck and spine control without the worsening of symptoms or cervical/ spinal pain during return to play and return to learn progression.

BEHAVIORAL/ COGNITIVE

**May require cognitive therapy and/or neuropsychological evaluation

Assessments & Evaluation:

- Symptom Log
- Memory, Dual tasking, and Processing
- Cognitive Tasks
- Behavioral Monitoring
- Physical Therapy Evaluation and Treatment
- Return to Play Progression
- Return to Learn Progression

Goals and Objectives

Recovery phase:
Improve supervised controlled return to previous academic and social environment.

Prior to Clearance:
Demonstrates ability to complete full participation in previous level of academia symptom free.

Able to participate in social activity symptom free.

Advanced Rehabilitation and Active Recovery

Our Advanced Rehabilitation Program is focused on a plan for active recovery that gets athletes moving sooner following a brain injury! The old rule was to shelter or "cocoon" athletes at home following concussion as well as eliminating stimulation completely to allow for the brain to heal. According to several recent studies, complete brain rest beyond 48-72 hours is controversial. Taking athletes completely out of their social environment, sport, and school day can lead to alternate diagnosis and issues such as slower recovery, psychological depression, or post-traumatic stress disorder. Remember do NOT GET ACTIVE until your healthcare provider tells you to. When returning to school, work, or sport, activity needs to be introduced in phases that are medically recommended at the right pace by your managing physician.

The Morahan Center is doing things DIFFERENTLY!

At the Morahan Center we get our athletes active sooner through clinically supervised exercise and rehabilitation programs that can accelerate recovery and find the root cause of symptoms sooner. The Morahan Center follows a calculated approach through the **MORAHAN CAARP™**, prescribing individualized programs based on physical and academic thresholds. Once our physician clears an athlete to begin supervised activity, our experienced team of athletic trainers, exercise physiologists, and physical therapists assess both acute concussion symptoms and prolonged symptoms. They also treat a wide span of brain injuries including those that heal quickly to those that can take weeks or even months to improve. Ocular-motor deficits, visual disturbances, cervical spine injuries, and other contributing factors can often be the root cause of lingering symptoms following concussion. With advanced evaluation tools and management plans, the multidisciplinary team at the Morahan Center can detect these issues right away and work with an athlete to correct them and retrain the body's visual and vestibular systems to a level and intensity that is safe for sport.

Dependent on the rate at which an athlete recovers, they will either be on a fast track back to the playing field or an extended care plan for symptoms lasting beyond two to three weeks. Placing athletes into "tracks" through the **MORAHAN CAARP™** provides an evidence-based approach for healing that is unique to the Morahan Center for improving patient outcomes and recovery timelines. This algorithm of care was recently recognized in publication at the at the International Conference on Concussion and Sport, the largest concussion conference in the world.

Post Concussion Syndrome (PCS)

We term the athletes that take longer to recover to be diagnosed with Post-Concussion Syndrome or PCS. PCS is a phase of recovery that goes well beyond the acute phase (several weeks to one month). Generally these types of brain injuries will take longer to heal and recover from those that resolve symptoms sooner. However, all athletes and patients have individually established symptom thresholds and limitations that are monitored by our comprehensive clinical team through low level exercise programs, treadmill testing, cognitive testing, and physical therapy evaluation and treatment. The variable assessments and methods of care help to establish safe parameters for exercise progression and return to learn (see chart on Return to play and Returnto Learn for more information).

Before you're back on the field, remember...

- ***Symptoms aren't gone if masked by medications***
- ***Full school days are required before return to full practice or sport can happen***
- ***A return of symptoms will will pause and restart the Return to Play progression***

New Treatment Plans

What's new with concussion testing?

Pediatric ImPACT testing is now available for ages 5-11 through the Morahan Center as well as a Pediatric Return to Play Program.

Why should I take myself out of the game when I have symptoms?

According to a 2016 study from the Journal of Pediatrics, athletes who continued to play with a sports related concussion and who were not removed from play, required nearly twice as long to recover than those who were immediately removed from play (44 vs 22 days). These athletes demonstrated worse symptoms at 1 to 7 days and at 8 to 30 days than athletes immediately removed from play.

What should I ask myself when recovering from a brain injury?

Do I still have symptoms during a school day?

Do I have difficulty with reading, concentrating, or focusing in a classroom?

Do I have difficulty sleeping or always feel tired?

Am I feeling more anxious or irritable than normal?

Feeling changes in the above categories following a concussion are NORMAL. ***REMEMBER* small improvements are *GREAT* improvements.** Don't just track the times you feel poorly but track the times you feel better!

If you answer yes to any of the above questions but you're feeling less severe symptoms it is a good sign you're taking the right steps towards success. Recovery takes time, but putting the work in, monitoring changes and reporting and recording how you feel regularly with the team managing your care makes all the difference in how quickly you'll heal. Remember to **BE HONEST** with yourself, your caregivers, and your school so that everyone can work together towards ***YOU*** and ***YOUR recovery.***

MYTHS and FACTS

MYTH:
You have to hit your head to sustain a concussion.

FACT:
A hard blow to the head, neck, face, body, or jaw can cause a concussion. Anything that moves the brain in the skull through a hard impact can lead to brain injury.

MYTH:
Imaging can diagnose a concussion.

FACT:
Acute concussion cannot be seen on standard imaging, MRI, or CT scans. Today, imaging is rarely ordered in the acute phase of an injury (initial week), but may be ordered later (several weeks following an injury) to look for alternative diagnosis if a patient is still reporting symptoms.

MYTH:
Neuro-cognitive testing (ImPACT testing) and other modes of assessment (King-Devick Testing, Vestibular Ocular Motor Screening) can diagnose a concussion.

FACT:
All testing post-concussion are tools that are used to help a physician reach a diagnosis. These types of testing do not diagnose a concussion, a physician does. The comprehensive testing along with a thorough physician exam and symptom assessment give the physician confidence in making a diagnosis and appropriate treatment plan.

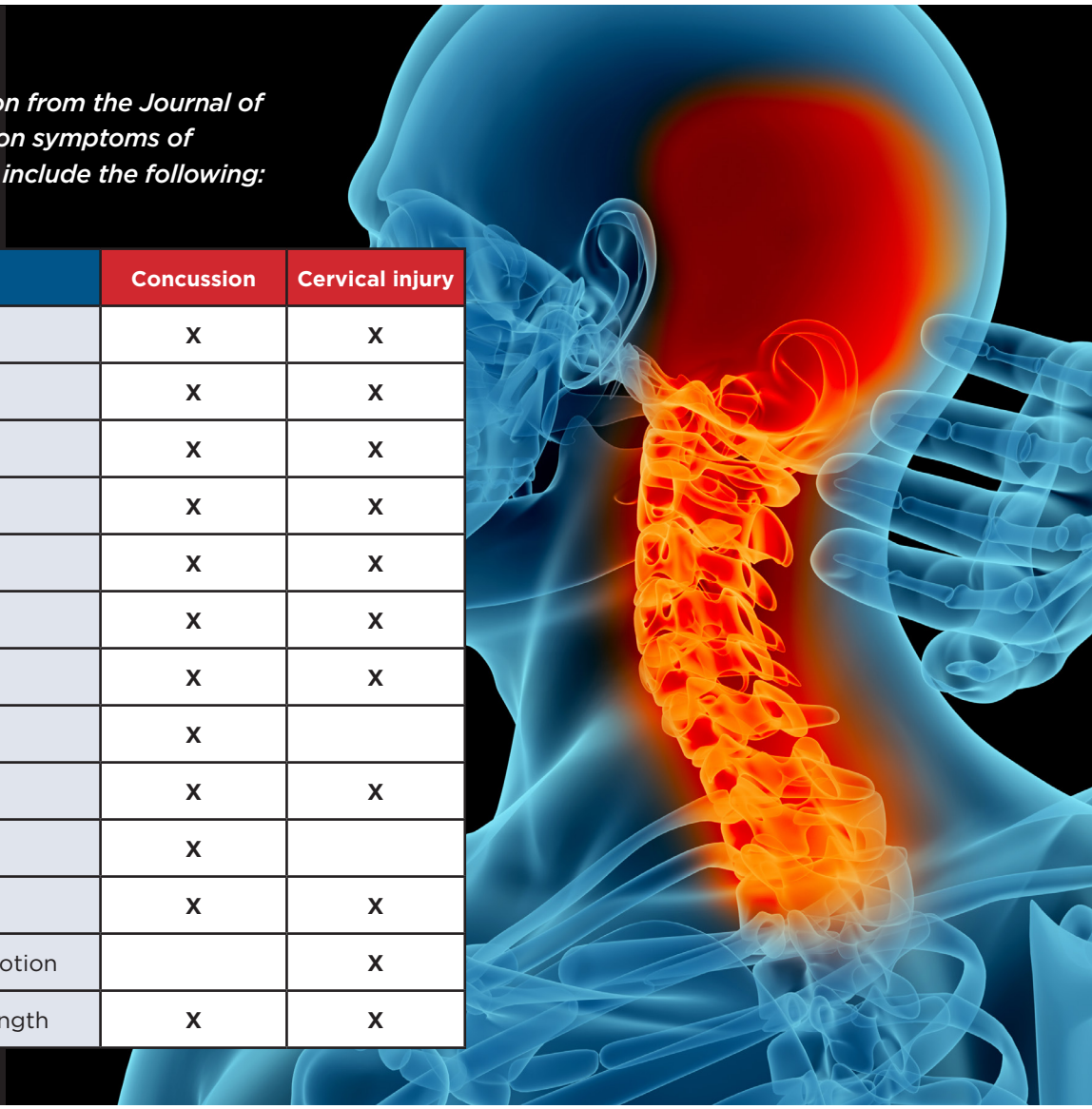
MYTH:
Every concussion I have should heal in the same amount of time.

FACT:
ALL brain injuries heal at different speeds. Evidence shows, that with every concussion, risk of more prolonged recovery increases. Recovery timelines are often extended with each subsequent concussion especially if the first concussion never healed properly or was cleared too early to return to activity.

Healing Time For Your Spine

According to a 2016 publication from the Journal of Athletic Training, some common symptoms of concussion and cervical injury include the following:

Symptoms	Concussion	Cervical injury
Headache	X	X
Dizziness	X	X
Irritability	X	X
Sleep disturbances	X	X
Blurred vision	X	X
Neck stiffness	X	X
Balance disturbances	X	X
Depression	X	
Cognitive deficits	X	X
Memory deficits	X	
Attention deficits	X	X
Decreased cervical range of motion		X
Decreased isometric neck strength	X	X



Cervical spine injuries are very common in any whiplash or sports based injuries that occur that jar the head in a forward and backward motion within the skull. Cervical injuries and concussion have significant overlap in symptoms, which makes it challenging to pinpoint the exact source of where these symptoms are coming from. In fact, more research is needed to determine an identifiable way for physicians to rule out concussion when diagnosing cervical injury.

At the Morahan Center, we do an extremely comprehensive evaluation to assess vision, motor, cognitive, and physical limitations inhibiting symptoms from resolving. If cervical spine injury is detected, basic neck range of motion exercises may be prescribed as part of a patient's active recovery plan. In keeping the neck active and identifying these issues early on, the Morahan Center strives to get ahead of the symptom progression before they have an opportunity to worsen.

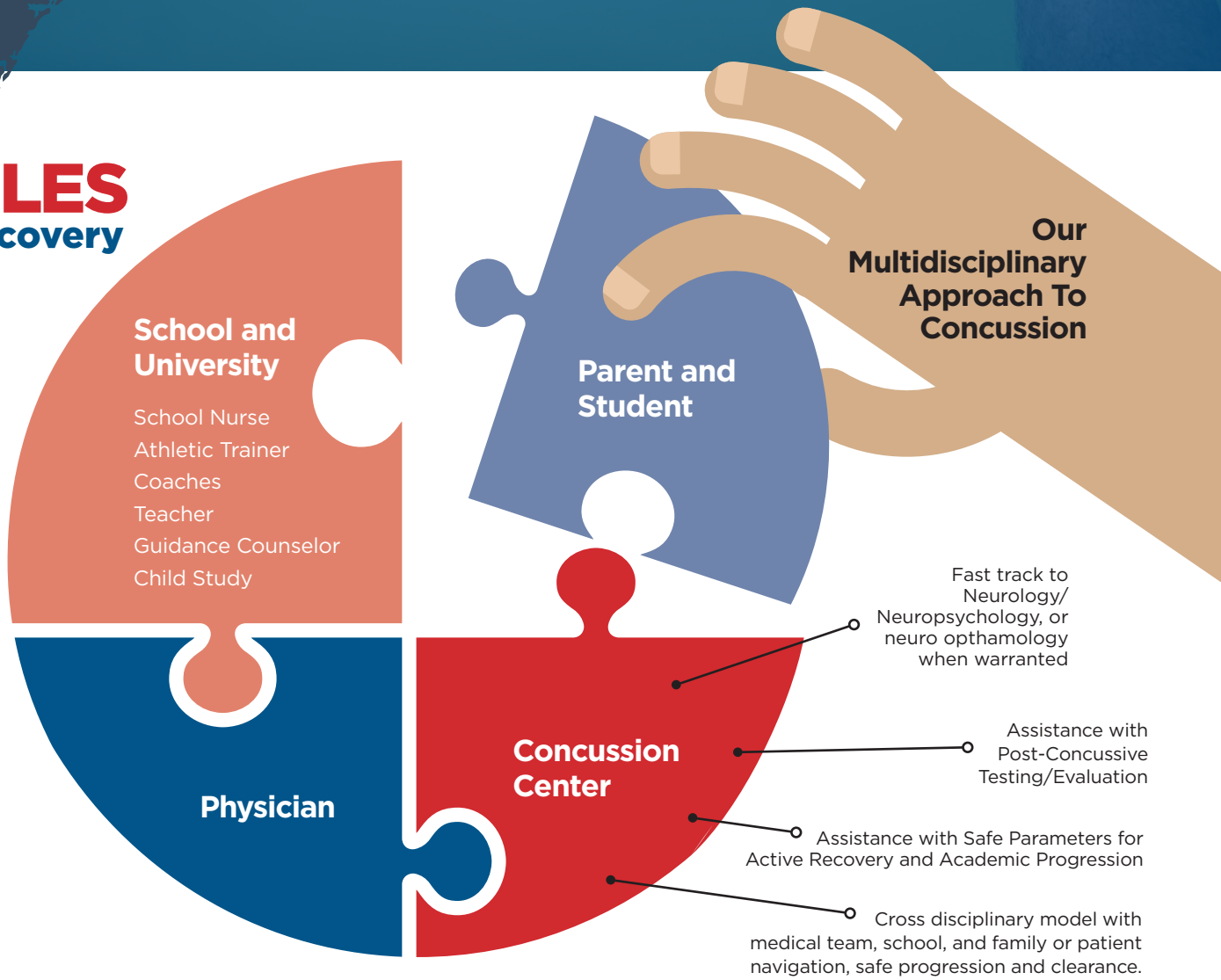
NJ Legislature Taking Action

In 2010, the NJ state legislature developed a Concussion Law that was mandated in interscholastic sports programs to remove a student athlete that has a concussion from competition, practice, or return to play until they are evaluated and cleared by a physician that specializes in the evaluation and management of concussions.

Sneak Peak At Future Legislation

In 2016, a Return to Learn Bill was passed by General Assembly in the State of New Jersey. If passed into law this could require in the future that a physician clearance is mandated to return to school, not just to return to play.

ROLES to Recovery



Locations:

RWJBarnabas Health Ambulatory Care Center
200 South Orange Avenue, Livingston, NJ 07039

Jersey City Medical Center Rehabilitation Services
RWJBarnabas Health Medical Group
100 Town Square Place, Suite 403, Jersey City, NJ 07310

Contact the Matthew J. Morahan III Health Assessment Center for Athletes by calling **973-322-7913**.

Additional Educational Patient Resources

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