Early Return to Activity Following Concussion

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Presentation Goals

Early Return to Activity Following Concussion

By attending this presentation, participants will be able to:
1. Provide three advantages associated with an early return to light physical activity following a concussion.
2. Identify potential pitfalls of an overly restrictive “brain rest” protocol following a concussion.
3. Develop an appropriate early return to activity protocol for patients in the early period of concussion recovery based on the research to date.
Cultural Zeitgeist

- Concussion management in the US is moving in the right direction, though confusion remains about appropriate treatment.
- Media and high profile legal cases are raising anxiety in the general populace.
- Many different disciplines are becoming involved in the care of individuals with concussion.
- Concussion management can be complex and the non-specific nature of the symptoms can obfuscate the treatment course.

Definition of Concussion

CDC Physicians Toolkit 2007

A concussion (or mild traumatic brain injury) is a complex pathophysiological process affecting the brain, induced by traumatic biomechanical forces secondary to direct or indirect forces to the head. Disturbance of brain function is related to neurometabolic dysfunction, rather than structural brain injury, and is typically associated with normal structural imaging findings (CT Scan, MRI).

Concussion may or may not involve a loss of consciousness. **Concussion results in a constellation of physical, cognitive, emotional, and sleep-related symptoms.** Recovery is a sequential process and symptoms may last from several minutes to days, weeks, months, or even longer in some cases.”

CDC Physicians Toolkit; Collins, Gioia et al 2006
What Is A Mild TBI?

- **By Definition**
  - < 1 hour LOC
  - < 24 hours of PTC/PTA
  - Normal neuroradiologic results
- **Wide range of severity** across patients diagnosed with mTBI
- Most sport-related concussion do not involve loss of consciousness

Epidemiology of Sports Related Concussion in the U.S.

- In 1999, a CDC study estimated 300,000 sports and recreation-related TBIs per year (Thurman, et al., 1999)
  - This study included only those who experienced LOC
- Other studies show concussion resulting in LOC account for only 8–19% of sports-related TBIs (Collins, et al., 2003; Schultz et al., 2004)
- Current studies suggest that approximately 1.6 to 3.8 million sports-related concussions occur each year (CDC Physicians Toolkit, 2007)
- Between 2006 and 2011, ED visits for concussion increased (28.1%) with a corresponding increase in head CT utilization (35.7%).
- This was noted despite a decrease in injury severity during that same time frame.
- Many less severe head injuries are treated at physician’s offices, immediate care centers, or self–treated.

Zonillo, Kim, & Arbogastl Acad Emerg Med, 2015
When a player shows ANY features of a concussion...

- The player should be medically evaluated onsite using standard emergency management principles, and particular attention should be given to excluding a cervical spine injury.

- The appropriate disposition of the player must be determined by the treating health care provider in a timely manner. If no health care provider is available, the player should be safely removed from practice or play and urgent referral to a physician arranged.

- Once the first aid issues are addressed, then an assessment of the concussive injury should be made using the SCAT3 or other similar tool.

- The player should not be left alone following the injury, and serial monitoring for deterioration is essential over the initial few hours following injury.

- **A player with diagnosed concussion should not be allowed to RTP on the day of injury.**

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Emergency Symptoms of a Concussion

- If your athlete is experiencing any of the following symptoms, seek emergency care:
  - Changes in alertness or consciousness
  - Convulsions
  - Muscle weakness or numbness on one or both sides
  - Persistent or worsening unsteady gait
  - Slurred speech
  - Unusual behavior
  - Repeated vomiting
  - Unequal pupils
  - Unusual eye movements
  - Seizure activity
Risk of Recurrence

- National Center for Catastrophic Sports Injury Research
  - Study of scholastic sports injuries over 13 seasons (1989-2002)
  - Catastrophic injuries
    - 40% were playing with mild symptoms from prior injury
    - 71% were injuries from same season
- National High School Sports-Related Injury Surveillance Study
  - 68,000 Concussion during 2008 Season
  - 16% of Players with LOC returned to field the same day

Same Day Return To Play

- There are data demonstrating that at the collegiate and high school levels, athletes allowed to RTP on the same day may demonstrate NP deficits post-injury that may not be evident on the sidelines and are more likely to have delayed onset of symptoms.

- It should be emphasized that the young (less than 18 years old) elite athlete should be treated more conservatively, even though the resources may be the same as for an older professional athlete.
Changes in Mindset

- “Emerging science supports acute management and evaluation to prevent recurrent concussions before full recovery from prior injury.”

- State Laws – In all 50 States
  - Washington Zackery Lystedt Law
    - First state legislation 2009
  - Texas – 2011 (Natasha’s Law)
  - Last state: MS – Jan 2014

- When in doubt...

Revised AAN Guidelines (2013)

- Now “Evidence Based”
  - Immediate removal from play if concussion suspected
  - Grading system no longer the deciding factor
  - Focus is now on individual management
  - No set timeline for return to play
  - No return until assessed by a licensed health care professional trained in concussion.
  - Return to play slowly after acute symptoms resolve.
    - High school and younger – manage more conservatively due to longer recovery.
  - First 10 days after a concussion is the period of greatest risk for another concussion.
The current treatment/management of concussion is primarily based on expert consensus rather than evidence based practice.

Most clinical practice guidelines advise cognitive and physical rest after injury including withdrawal from normal life activities such as school attendance, sports participation, and technology use until symptoms resolve.

The rationale is that the brain needs rest to normalize the metabolic and other neurologic changes that occur as a result of an injury to the brain.

Some of these protocols are quite restrictive and call for a period of “total brain rest” until symptom resolution has occurred.

Some have no timeframe included – just symptom resolution

This may last days, weeks, months, or even longer*

This is particularly the case for children where we are repeatedly advised to take a more conservative approach to concussion management.
LUBBOCK, Texas -- Texas Tech fired coach Mike Leach on Wednesday, two days after he was suspended by the school as it investigated his treatment of a player with a concussion.

Leach was suspended by the university on Monday as the school investigated his treatment of James. The sophomore alleged the coach twice confined him to small, dark spaces while the team practiced.
Concussion Management, cont.

- Proper management prevents future problems – Agree

- Determination of asymptomatic status is essential for reducing repetitive and chronic morbidity associated with the injury. – Agree
  - But as noted in the prior presentation this is difficult to determine.

- Concussion management should take an individualized approach rather than a formula driven “system”. – Agree

Symptom endorsement in the non-injured

- Specific endorsement rates of postconcussion–like symptoms ranged from 35.9% to 75.7% for any experience of the symptoms in the past 2 weeks, and from 2.9% to 15.5% for the experience of more severe symptoms

- Symptoms reported also showed a moderately high correlation with self–reported depressive symptoms

- This study illustrates that the presence of postconcussion–like symptoms:
  - (a) are not unique to mild head injury and are commonly found in healthy individuals
  - (b) are highly correlated with depressive symptoms
Concussion Management

The Basics

- Acute Management
  - R/O more severe intracranial pathology via neuroimaging, neurology examination, etc. if warranted

- Post Injury Management
  - No return to play on the day of injury
  - No return to play while symptomatic or symptomatic with exertion
  - Limited cognitive/physical exertion during symptomatic phase
  - Careful monitored and gradual increase in exertion over time

- Most agree with the basics...

Concussion Management

- Need for conservative management in children/adolescents – Agree

- Neurocognitive testing recommended for athletes sustaining concussion – Agree
  - Need for implementation in clinics as a tool to help determine academic needs, when to return to exertion, return to play decision, treatment/rehabilitation
  - More extensive neuropsychological testing indicated in complicated cases.

- Decisions regarding concussion management and return to play lie largely in the realm of clinical judgment and must be made on an individual basis. – Agree
Return To Play Decisions

- Three main criteria must be met before an athlete resumes athletic activity (including practice or conditioning):
  1. Consistently symptom free at rest
  2. Consistently symptom free after exertion (physical or mental)
  3. Return to baseline/normal neurocognitive functioning on objective testing

Sort of Agree...

Management of Post Concussive Symptoms

New Research – New Ideas
Brain Rest

- Recommendations for brain rest are based on basic science animal studies
  - Show metabolic crisis following TBI in mice brains
  - A second injury results in worse pathophysiology and behavioral deficits
  - Animals allowed to exercise immediately following injury do not show the same molecular markers of plasticity
- Rest is thought to facilitate a normalization of the metabolic crisis
- Some evidence that symptoms increase during school demands in the first 2 weeks following concussion (Gioia, 2010)

DiFazio et al., Clinical Pediatrics, 2015

Where Did The Brain Rest Idea Come From?

- Early advocacy for rest in the 1920’s & 30’s were countered with skepticism by the 1950s, when several authors cautioned of the potential psychological and physiological harmful effects of prolonged rest.
- The first Consensus Statement on Concussion in Sport (2001) introduced “no activity, complete rest” as the initial step toward return to play following sport-related concussion, and this was recommended until all symptoms resolved.
- This was again endorsed in the next 2 iterations of the Consensus Statement on Concussion in Sport (2005, 2009).

Where Did The Brain Rest Idea Come From?

- By the fourth consensus meeting (2013), the statement acknowledged that the evidence base for the efficacy of rest is "sparse" and the benefits of resting for more than 48 hours post-injury require further study.
- However, they added that “it is appropriate to extend the amount of time of asymptomatic rest for children.”
- Despite this, the consensus of many experts continued to recommend total brain rest until the player is asymptomatic.
- A parallel return to school guideline similarly advises no school attendance until the child is symptom free or after 4 weeks of persistent symptoms with physician clearance.


Challenges to Prescribed Rest

- Research in other disciplines has repeatedly shown deleterious effects of complete rest
- Bed Rest – changes to cardiac and pulmonary function within 3 days, sleep within 3–6 days (Fortney 2011)
- Mood changes within a week
- Aeronautical studies of weightlessness leading up to space launch showed adverse affects to all major organ systems
- Total inactivity negatively impacts health

Knight, Nigam, & Jones, 2009
Possible Harmful Effects

- Anxiety, Expectations, and the Nocebo Effect
- Depression and Other Psychological Complications
- Physical Deconditioning
- Potential for a cycle of symptoms
- [Potential for major school problems]


Challenges to Prescribed Brain Rest

- Rest is widely described, but poorly defined
- Adherence to brain rest protocols is incomplete at best
- Activity restriction does not keep the brain at “rest”
- There are no published studies to show that the practice of brain rest results in better clinical outcomes

Mixed Opinions of Harm/Benefits of Brain Rest After Concussion

- Recommending strict rest for adolescents immediately after concussion offered no added benefit over the usual care. Also adolescents’ symptom reporting was higher in the group receiving strict rest.
- Participants that engaged in the highest levels of cognitive activity had the longest times to symptom resolution.
Early Return to Activity – Successes

- Rapid (1st post-op day) mobilization following total joint replacement – safe and reduces hospital length of stays (Tayrose et al, 2013)
- Rapid mobilization (24 hours) following stroke significantly improved time to independent walking and functional outcomes (Cumming et al, 2011)
The Key Is Balance

- The highest and lowest levels of exertion after concussion had worse cognitive symptoms (Majerske, et al., J Athl Training, 2008)
- Post-injury exercise enhances recovery through increased brain-derived neurotrophic factor (BDNF) and can counteract increased oxidative stress that leads to free radicals. Also can regulate post-TBI neuroendocrine dysfunction (Griesbach, 2011)
- 1–2 days full rest followed by graduated activity/exercise; Main issue: protect from repeat injury (Wells, et al. Journal of Child Neurology, 2015)

Health Benefits of Exercise/Activity

Table 2  Selected moderate and vigorous activities, physiologic pathways, and health outcomes

<table>
<thead>
<tr>
<th>Examples of Physical activities</th>
<th>Examples of Physiologic changes</th>
<th>Examples of Health outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gardening</td>
<td>↑ Autonomic balance</td>
<td>↓ Breast cancer</td>
</tr>
<tr>
<td>Home repair</td>
<td>↑ Bone density</td>
<td>↓ Colon cancer</td>
</tr>
<tr>
<td>Painting</td>
<td>↑ Capillary density</td>
<td>↓ Coronary heart disease</td>
</tr>
<tr>
<td>Raking</td>
<td>↑ Coronary artery size</td>
<td>↓ Depression</td>
</tr>
<tr>
<td>Shoveling</td>
<td>↑ Endothelial function</td>
<td>↓ Excess weight gain</td>
</tr>
<tr>
<td>Sweeping</td>
<td>↑ High density lipoprotein</td>
<td>↓ Fractures</td>
</tr>
<tr>
<td>Vacuuming</td>
<td>↑ Immune function</td>
<td>↓ Injuries, falls</td>
</tr>
<tr>
<td>Basketball</td>
<td>↑ Insulin sensitivity</td>
<td>↓ Osteoporosis</td>
</tr>
<tr>
<td>Cycling</td>
<td>↑ Lean body mass</td>
<td>↓ Risk of death</td>
</tr>
<tr>
<td>Dancing</td>
<td>↑ Mitochondrial volume</td>
<td>↓ Stroke</td>
</tr>
<tr>
<td>Running</td>
<td>↑ Motor unit recruitment</td>
<td>↓ Type 2 diabetes</td>
</tr>
<tr>
<td>Skiing</td>
<td>↑ Muscle fiber size</td>
<td>↑ Cognitive function</td>
</tr>
<tr>
<td>Soccers</td>
<td>↑ Neuromuscular coordination</td>
<td>↑ Physical function</td>
</tr>
<tr>
<td>Swimming</td>
<td>↑ Stroke volume</td>
<td>↑ Weight management</td>
</tr>
<tr>
<td>Tennis</td>
<td>↓ Blood clotting</td>
<td></td>
</tr>
<tr>
<td>Walking</td>
<td>↓ Inflammation</td>
<td></td>
</tr>
</tbody>
</table>

*Arrows indicate direction of physiologic change or health outcome associated with increased physical activity. The Table is designed to be read from left to right but not line by line. Different physical activities act through a variety of physiologic pathways to influence different health outcomes.
Questions Have Been Raised About Total Brain Rest…

- And the answers bring optimism…

- Prolonged rest may do more harm than good, and as with other interventions, the potential benefits of prescribing long-term rest or withdrawal from activities should be weighed against the potential harms.

Does a Return To Activity Mean a Return To Play?

- No…
  - The standard rules still apply for Return to Play/Return to Athletics/Return to Competition
    - Symptom Free at Rest
    - Symptom Free with Exertion
    - Presumed baseline neurocognitive functioning

- The hope is that a return to activity will help manage the factors that result in prolonged recovery and PPCS
Proposed Return To Activity

- Generally begins about 2–5 days post injury
- Similar to a Return to Play Protocol, but allows for a return to usual life activities in a gradual fashion
- Particularly useful for children and adolescents who are at risk of decreased socialization, emotional reactions, sleep problems, school declines, etc. as they are pulled away from their normal work, social, school, and family activities
- It involves taking the focus off of the concussion and related symptoms and putting it back on positive activities

Proposed Return To Activity

- Possible ideas
  - Walks around the block or at the mall
  - Attending meetings or practices with their team for socialization and support
  - Resuming school activities, possibly in a group setting
  - Meeting friends at a coffee shop or other low intensity location
  - Stretching/Yoga activities
  - Church or other organization activities
  - Eventual non-first person shooter video games
  - Others?
The goal is to have them normalize their life as the concussion symptoms normalize so that they are ready for the next step.

### Graduated Return To Play

<table>
<thead>
<tr>
<th>Day</th>
<th>Activity</th>
<th>Type of Exercise</th>
<th>Objective</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>No Activity</td>
<td>Complete Physical and Cognitive Rest</td>
<td>Recovery</td>
</tr>
<tr>
<td>2</td>
<td>Light Aerobic Exercise</td>
<td>Walking, Swimming, Bicycle No Resistance Training</td>
<td>Increase HR</td>
</tr>
<tr>
<td>3</td>
<td>Sport Specific Exercise</td>
<td>Skating Drills, Running Drills No Head Impact Activities</td>
<td>Add Movement</td>
</tr>
</tbody>
</table>
| 4   | Non-Contact Training Drills | Complex Training Drills  
Passing Drills  
Progressive Resistance Training        | Exercise, Coordination, Cognitive Load                                             |
| 5   | Full Contact Practice     | Following Medical Clearance  
Normal Training Activities                                                             | Restore Confidence  
Assess Functional Skills                                                                 |
| 6   | Return to Play            | Normal Game Play                                                                 |                                                 |

*MUST BE WITHOUT SYMPTOMS TO PROGRESS TO NEXT STAGE/DAY*
What About Return To School?

- School is the work setting for our kids and athletes.
- This is where they are challenged at the highest levels mentally, socially, physically, and emotionally.
- This is (or should be) their primary responsibility above sports activities.
- A gradual, but early return to school activities (even if it is part time or home-based) is often necessary to avoid getting too far behind.

Return to Learn: Academic Adjustments

- **Temporary** adjustments to academic demands
  - Consider impact of headache, fatigue, dizziness, light/noise sensitivity, poor sleep, ringing in ears
  - Consider impact of cognitive deficits like inattention, poor concentration, memory disruption, slowed processing, slowed task performance
- Critical issue is to ensure **brief rest** followed by resumption of modified academics
  - Need individualized plan to modify academic demands & school environment on temporary basis
  - Students must return to academics prior to return to competition
- **Academics before athletics!**
What About Return To School?

- All is on a continuum
  - Attendance and return to school
  - Workload – at home and school
  - Cognitive processing load
  - Managing the physical symptoms, fatigue, mood
- Testing accommodations
  - What is the purpose/reason?
  - What is the functional impact?
  - Time limited

M. Shapiro, SNS Symposium, 2015

What About Return To School?

- Return for specific subjects rather than all subjects
- Schedule flexibility
  - Time of day, class length, difficulty level
- Classwork versus Homework
- Speeded time requirements
- Premorbid work ethic, reputation, credibility
- EC activities
- Physical demands of the school
- Electronic schools

M. Shapiro, SNS Symposium, 2015
What About Return To School?

› School Hot Spots/Problem Areas
  ◦ Whiteboards
  ◦ Computers
  ◦ Position in classroom
  ◦ Partner work
  ◦ Crowded/noisy hallways
  ◦ Lunchroom
  ◦ Recess
  ◦ Music/band/orchestra/chorus
  ◦ Bus
  ◦ Testing

What About Return To School?

› Seasonal Issues – Sports and Non–Sports Related
  ◦ Testing Windows
  ◦ College Admission Tests
  ◦ Homecoming/Prom
  ◦ Playoffs
  ◦ Tryouts
  ◦ AP Testing
What About Return To School?

- The following was pulled from a website with a title indicating “Research-Based Practice” as a guide to returning to school after a concussion.
- While much of the information was very good, the “brain rest” dilemma was again raised.

What About Return To School?

- The school psychologist and/or the school nurse are the most skilled professionals at the school to help advise the parent and doctor when it is best to return the student to school. However, as the ultimate decision often/usually falls upon the parent, parents can utilize symptoms to determine when to safely return their student to school.

- If symptoms prevent the student from concentrating on mental activity for even up to 10 minutes at a time, rest is required. The student should be kept home from school on total bed rest with no (or very limited) television, video games, texting, reading, homework, or driving. Parents should consult a healthcare professional if this state lasts longer than a few days.

- If symptoms allow the student to concentrate on mental activity for up to 20 minutes at a time, parents should still consider keeping their student home from school, but total bed rest may not be necessary. Between periods of resting and napping, the student may engage in light mental activity, such as light reading or television, as long as these activities do not provoke symptoms.

- When the student is beginning to tolerate 30 minutes of light mental activity, parents can consider returning him or her to school.
Just like physical activities, school activities should be resumed in a gradual, but balanced, early fashion to maximize success while minimizing symptom exacerbation.

Most recover from concussion in a period of 1 to 4 weeks. Total brain rest for extended periods of time can be detrimental and may result in PPCS. Over exertion (physical or mental) can also be detrimental and may result in PPCS. Remember the risk factors for PPCS described in the earlier presentation and consider those as you look to promote early activity (not necessarily exercise) in your athletes with concussions. Help them expect improvement! Help them return to play, to work, to their normal life.
Concussions are bad for your brain! Any questions?

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Baylor Institute for Rehabilitation
Concussion Management Program

Now part of Baylor Scott & White Health