Rest and Rehabilitation for Concussion and the Post-Concussion Syndrome

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• Independent practice in forensic neuropsychology, including athletes
Initial “Management” of Concussion

• “Management”, not treatment or rehabilitation
• Components
  – Education and Reassurance
  – Prescribed Rest
  – Gradual Activity Resumption
  – Return to School, Sports, Work, or Duty
Basic Principles for Treatment and Rehabilitation: Initial Weeks Following Injury (and sometimes months following injury)

• Focused, Evidence-Based Treatment for Specific Symptoms and Problems
  – Medications
  – Physical Therapy
  – Vestibular Rehabilitation
  – Exercise
  – Psychological Treatment
Treatment & Rehabilitation

Part 1: Rest
Rest Following Injury

How much and for how long?
Critical Questions

• How do we define “rest”?
• How long should an athlete rest?
• How do we define gradual resumption of activities?
• How much rest is too much rest?
• When should we begin active rehabilitation?
What is the rationale for rest?

• The injured brain might be in a state of neurometabolic crisis.

• Assuming that neurometabolic crisis involves an “energy crisis,” then vigorous activity might compound or magnify the energy crisis.

• Passing another mechanical force through the injured brain, while it is in a state of neurometabolic crisis, might result in magnified pathophysiology.
"Playing Through It": Delayed Reporting and Removal From Athletic Activity After Concussion Predicts Prolonged Recovery (Asken et al., 2016)

- Ninety-seven collegiate athletes who sustained a sport-related concussion between 2008 and 2015. Athletes were grouped as immediate removal from activity or delayed removal from activity.

- The Delayed Return athletes averaged 4.9 more days missed than the Immediate Return athletes. The Delayed Return athletes were approximately 2.2 times more likely to have a prolonged recovery (8 or more days) compared with the Immediate Return athletes.
Playing Injured and Recovery Time
(Elbin et al., 2016; Pediatrics)

Methods

• A prospective, repeated measures design.
• 35 youth removed from play following concussion vs. 35 who continued to play
• Neurocognitive and symptom data were obtained at baseline and at 1 to 7 days and 8 to 30 days after injury.

Results

The PLAYED group took longer to recover than the REMOVED group (44.4 ± 36.0 vs 22.0 ± 18.7 days; P = .003) and were 8.80 times more likely to demonstrate protracted recovery (≥21 days) (P<.001). The PLAYED group exhibited significantly worse neurocognitive and greater symptoms than the REMOVED group.
Why Question Bed Rest?
Systematic Review of Bed Rest in Medicine (Allen et al., 1999)

• In 24 trials investigating bed rest following a medical procedure, no outcomes improved significantly and eight worsened significantly in some procedures.

• In 15 trials investigating bed rest as a primary treatment, no outcomes improved significantly and nine worsened significantly for some conditions.
Bed rest might cause or exacerbate certain symptoms

- After 3-6 days of bed rest, some people complain of headache, restlessness, and difficulty sleeping.

Fortney, Schneider, and Greenleaf (2011)
Two Clinical Trials: (Bed) Rest Did Not Improve Outcomes

Effectiveness of bed rest after mild traumatic brain injury: a randomised trial of no versus six days of bed rest

J R de Kruijff, P Leffers, S Meerhoff, J Rutten, A Twijnstra

J Neurol Neurosurg Psychiatry 2002;73:167–172

Benefits of Strict Rest After Acute Concussion: A Randomized Controlled Trial

Danny George Thomas, MD, MPH, Jennifer N. Apps, PhD, Raymond G. Hoffmann, PhD, Michael McCrea, PhD, Thomas Hammmeke, PhD

PEDIATRICS Volume 135, number 2, February 2015
Is Rest After Concussion “The Best Medicine?”: Recommendations for Activity Resumption Following Concussion in Athletes, Civilians, and Military Service Members

Noah D. Silverberg, PhD; Grant L. Iverson, PhD
• Silverberg and Iverson (2012) concluded that bed rest exceeding three days is not recommended and gradual resumption of pre-injury activities should begin as soon as tolerated.
Is rest in the initial days following concussion a good idea?

In my opinion, yes.
Possible Harms of Prolonged Rest

• Falling behind in school with increased associated stress
• Physical deconditioning and evolving exercise intolerance
• Nocebo effects (expectation of sickness as a cause of sickness)
• Somatic preoccupation and Cognitive Hypochondriasis
• Depression
Factors Related to Depression in Adolescents
(Lewinsohn et al., 1997)

• The authors examined a wide range of psychosocial variables in the following 3 groups of adolescents:
  – depressed cases (n = 48),
  – nonaffective disorder cases (n = 92), and
  – healthy controls (n = 1,079)

• The authors found 3 of the 44 variables assessed in this study to be strongly specific to depression:
  – self-consciousness
  – low self-esteem
  – a reduction in activities because of physical illness or injury.
What does the Sport Concussion Group 2012 Zurich Consensus Statement say?

• “In the absence of evidence-based recommendations, a sensible approach involves the gradual return to school and social activities (prior to contact sports) in a manner that does not result in a significant exacerbation of symptoms”

(McCrory et al., 2013)
Progressive Activity Process

- Six stage approach from ‘Rest’ to ‘Unrestricted Activity’
- Progression is measured across physical, cognitive, and vestibular domains
- Utilizes the Neurobehavioral Symptom Inventory (NSI) for symptom tracking
- Resting heart rate (HR) and blood pressure (BP) are used as physiological measures to evaluate activity tolerance

DoD photo by Sgt. Justin Naylor (left), MWR West Point photo (center), US MilitaryCycling.com photo (right)
# Stages of Progressive Activity

<table>
<thead>
<tr>
<th>Rehabilitation Stages</th>
<th>Description</th>
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<tbody>
<tr>
<td>Stage 1</td>
<td>Rest</td>
</tr>
<tr>
<td>Stage 2</td>
<td>Light Routine Activity</td>
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<tr>
<td>Stage 3</td>
<td>Light Occupation-oriented Activity</td>
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<tr>
<td>Stage 4</td>
<td>Moderate Activity</td>
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<tr>
<td>Stage 5</td>
<td>Intensive Activity</td>
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<tr>
<td>Stage 6</td>
<td>Unrestricted Activity</td>
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Treatment & Rehabilitation

Part 2: Psychological and Behavioral Treatment
Athletes with a Pronounced Adverse Psychological Reaction to Injury
Reactions to Injury

• Anxiety, stress, worry, fear
• Anger
• Discouragement
• Sleep disturbance
• Mild depression
• Altered sense of self
Psychological Treatments to Consider

• CBT for Anxiety
• CBT and Behavioral Activation for Depression
• CBT for Insomnia
• Mindfulness for Anxiety
• Relaxation Training for Anxiety and Sleep Problems
Treatment & Rehabilitation

Part 3: Exercise as Treatment
Exercise as Treatment

• Exercise facilitates molecular markers of neuroplasticity and promotes neurogenesis in the healthy rodent brain and the injured brain.

• Associated with changes in neurotransmitter systems (Chaouloff, 1989; Molteni, Ying, & Gomez-Pinilla, 2002).
Exercise

• Improved mood and lower stress (Callaghan, 2004; Conn, 2010)

• Improved sleep quality (Youngstedt, 2005)

• Positive effects on self-esteem (Ekeland, Heian, Hagen, Abbott, & Nordheim, 2004)
Exercise

• Effective treatment, or adjunctive treatment, for mild forms of anxiety and depression (Daley, 2008; Mead et al., 2009; Rethorst, Wipfli, & Landers, 2009)

• Associated with reduced pain and disability in patients with chronic low back pain (Bell & Burnett, 2009; Henchoz & Kai-Lik So, 2008)

• Regular long-term aerobic exercise reduces migraine frequency, severity, and duration (Koseoglu, Akboyraz, Soyuer, & Ersoy, 2003; Lockett & Campbell, 1992)
Research on Exercise for MTBI

- Several small studies suggest exercise training is helpful for persistent symptoms in adolescents and adults.
Exercise for the Post-Concussion Syndrome in Adults (Leddy et al. 2010)

• Intervention: Subsymptom threshold daily aerobic exercise

• Design: Crossover study of 12 patients with persistent symptoms following a concussion (>6 weeks, <12 months).

• Participants exercised 5–6 times per week until they were asymptomatic with exhaustive exercise.

• Average time to completion of treatment: Athletes: 25 days; Non-Athletes: 75 days

• All patients were able to return to pre-injury levels of activity.
Active rehabilitation for children who are slow to recover following sport-related concussion

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Active Rehab for Slow-to-Recover Children

- Montreal Children’s Hospital (since 2007)
- Implemented after one month post injury
- For this group, significant lifestyle restrictions, including avoiding physical activity, can actually contribute to symptom maintenance over time.
- The longer a child (or adult) has symptoms, the more likely it is that other factors that are separate from or only partially related to the neurobiology of the original injury are causing or maintaining the symptoms.

Gagnon, Galli, Friedman, and Iverson (2009)
Submaximal Aerobic Exercises
60% max capacity
Treadmill or stationary bicycle
Up to 15 min or stop if symptoms increase

Home Program
Same Activities, Same intensity
For 1 week

Coordination exercises
Sport related, footwork or ball activities
Up to 10 min or stop if symptoms increase
(Later stages: anaerobic activities)
First Study

• All 16 of the children and adolescents who participated in the program experienced a relatively rapid recovery and returned to their normal lifestyles and sport participation.

Gagnon et al. 2009
A pilot study of active rehabilitation for adolescents who are slow to recover from sport-related concussion

I. Gagnon¹,²,³, L. Grilli², D. Friedman²,³,⁴, G. L. Iverson⁵,⁶,⁷,⁸
Second Study: Slow to Recover Adolescents (sport-related concussions)

- Gagnon et al. (2015)

- 10 adolescents who were symptomatic for more than 1 month post injury

- Duration of rehab: 2-15 weeks

- All 10 experienced improvement in symptoms and functioning during the course of treatment, achieved asymptomatic status, and returned to full activity participation (including sports).
Recently Published Small Randomized Clinical Trial (Kurowski et al., 2016)

- Participants: 30 adolescents with persistent symptoms from between 4 and 16 weeks.
- Design: Partially blinded, pilot RCT of subsymptom exacerbation aerobic training compared with a full-body stretching program. At least 6 weeks of treatment.
- Results: There was a greater rate of improvement in the subsymptom exacerbation aerobic training group than in the full-body stretching group.
- Conclusion: Subsymptom exacerbation aerobic training is potentially beneficial for adolescents with persistent symptoms after an MTBI.
Figure 3. Trajectory of self-reported Post-Concussion Symptom Inventory ratings. Means and standard deviations (represented by error bars) are reported for each weekly visit.
What does the 2012 Zurich Consensus Statement say?

• “Low-level exercise for those who are slow to recover may be of benefit, although the optimal timing following injury for initiation of this treatment is currently unknown” (McCrory et al., 2013)
Persistent Symptoms and Problems
Civilians who sustain an MTBI are at substantially increased risk for experiencing depression in the first year following injury.

The etiology of depression is likely individualized and multifactorial.
Post-concussion-like symptoms can be mimicked or magnified by traumatic stress, anxiety, pain, depression, sleep disturbance, and social psychological factors at any point in the recovery trajectory.
Individuals who are symptomatic at 3-6 months are at considerable risk for being symptomatic at 1-2 years post injury.
Introduction to the Post-Concussion Syndrome

• What is it?
• How long does it last?
• Can it be misdiagnosed?
ICD-10 Criteria for Postconcussional Syndrome

• Must endorse symptoms in at least 3 domains
  – Physical (e.g., headache, dizziness, balance problem, noise sensitivity, and/or fatigue)
  – Emotional (e.g., irritability, sadness, anxiety),
  – Cognitive
  – Insomnia
  – Excessive worry over symptoms
  – Intolerance for alcohol
Post-Concussion Syndrome

• More common in women than men.
• Pre-injury mental health problems are a major risk factor.
• It is associated with or influenced by traumatic stress in service members, veterans, and civilians.
• Persistent symptoms at 1 or 3 months are a risk factor for persistent symptoms at 1 year.
• Easy to misdiagnose in people with depression, anxiety, PTSD, and chronic pain.
The symptoms of mild TBI can be mimicked or magnified by traumatic stress, anxiety, pain, depression, sleep disturbance, and social psychological factors at any point during recovery.
“Postconcussion-Like” Symptoms are Common in:

University students
Mental health outpatients
General medical patients
Chronic pain patients
Personal injury litigants
Approximately 90% of people with depression, with no prior head trauma, will meet symptom criteria for a mild or greater form of ICD-10 Postconcussional Syndrome.
Psychological Treatment for People with Chronic Problems
Psychological Treatment

• Cognitive Behavior Therapy
• Self-Management
• Behavioral Activation
• Stress Management
• Acceptance & Commitment Therapy
Conclusions

• In the past few years there has been increasing recognition that:
  – rest is not sufficient for some people,
  – too much rest and activity restriction can have negative consequences, and
  – active rehabilitation is indicated for some people.
Future Directions

• Determining the optimal or preferred amount of rest (including defining rest, activity restrictions, and activity resumption)

• Determining the role of exercise as a component of active rehabilitation (including when to begin, frequency, intensity, and other parameters)

• Tailoring specific treatment and rehabilitation strategies for specific problems (including when to initiate, frequency, and duration)
Careful and Comprehensive Assessment = Targets for Treatment and Rehabilitation
Reduce Symptoms; Improve Function

- Sleep Disturbance
  - Stress & Anxiety
  - Depression
- Deconditioning
- Headaches
  - Bodily Pain
Vestibular Injury
Brain Injury
Chronic Headaches
Chronic Bodily Pain
Insomnia/Sleep Disturbance
Life Stress
Post-Traumatic Stress
Anxiety/Cognitive Hypochondriasis
Depression
Cognitive Difficulty & PCS Symptoms

Treat what you can treat. Success begets success.
Reduce symptoms. Improve functioning.
Resources

Websites:
Defense and Veterans Brain Injury Center
Ontario Neurotrauma Foundation
Resources:
Defense and Veterans Brain Injury Center
http://dvbic.dcoe.mil/resources/browse

DCoE Clinical Recommendation | January 2013
Assessment and Management of Visual Dysfunction Associated with Mild Traumatic Brain Injury

DCoE Clinical Recommendation | August 2012
Indications and Conditions for Neuroendocrine Dysfunction Screening Post Mild Traumatic Brain Injury

DCoE Clinical Recommendation | June 2014
Management of Sleep Disturbances Following Concussion/Mild Traumatic Brain Injury: Guidance for Primary Care Management in Deployed and Non-Deployed Settings
DCoE Clinical Recommendation | January 2014

Progressive Return to Activity Following Acute Concussion/Mild Traumatic Brain Injury: Guidance for the Primary Care Manager in Deployed and Non-deployed Settings

DCoE Clinical Recommendation | September 2012

Assessment and Management of Dizziness Associated with Mild TBI
Guidelines for Diagnosing and Managing Pediatric Concussion

First edition, June 2014

CONCUSSIONS
- Headache
- Confusion
- Blurry Vision
- Sickness

I feel weird!
This position statement, from 2013, contains a fairly large section on treatment for acute, subacute, and persistent symptoms.

American Medical Society for Sports Medicine position statement: concussion in sport

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Endorsed by the National Trainers’ Athletic Association and the American College of Sports Medicine