“Playing Through It”:
Delayed Reporting and Removal from Athletic Activity Following Concussion Predicts Prolonged Recovery

James R. Clugston, MD, MS
“Playing Through It”: Delayed Reporting and Removal From Athletic Activity After Concussion Predicts Prolonged Recovery

Breton M. Asken, MS, ATC*; Michael A. McCrea, PhD, ABPP/CN†; James R. Clugston, MD, MS, CAQSM‡; Aliyah R. Snyder, MS*; Zachary M. Houck, BS*; Russell M. Bauer, PhD, ABPP/CN*

*Department of Clinical and Health Psychology, †Department of Community Health and Family Medicine, and University Athletic Association, University of Florida, Gainesville; ‡Department of Neurosurgery, Medical College of Wisconsin, Waukesha

**Context:** Preclinical research has demonstrated a window of vulnerability in the immediate aftermath of concussion wherein continued activity and stimulation can impair or prolong neurobehavioral recovery. However, this concept has not been quantified in a human population.

**Objective:** To examine the effect of delayed reporting and removal from athletic activity after concussion on recovery time, symptoms, and return to play.

**Results:** The D-RFA athletes were approximately 2.2 times more likely to have a prolonged recovery (8 or more days) than I-RFA athletes (RR = 2.2, 95% CI = 1.2-4.0). This relationship was statistically significant (P = 0.04).

**Conclusion:** The findings suggest that delayed reporting and removal from athletic activity after concussion may predict prolonged recovery and subsequent return to play.
• Introduction
  – Observation and preclinical research suggests a window of vulnerability for **exacerbated injury when activity is resumed or continued** in the immediate aftermath of a concussion.
  – The extent to which this occurs is unknown.
• Purpose
  – To examine the effect of delayed reporting/removal from athletic activity after concussion on recovery time.
  – Hypothesis:
    • Delayed removal would be associated with prolonged recovery
• Methods and Study Design
  – IRB approval obtained (UFIRB#201500565)
  – Accessed data from the University of Florida Athletic Association Concussion Databank (UFIRB#201501050)
  – Retrospective cross-sectional design
• Methods and Study Design (cont.)
  – Ninety-seven (97) athletes (age=20.4 ± 1.3 years) who sustained a sport-related concussion between 2008 and 2015
    • Football (67), Women’s Lacrosse (7), Men’s Basketball (6), Women’s Soccer (5), Women’s Basketball (4), Women’s Volleyball (3), Men’s Swimming & Diving (2), Women’s Gymnastics (1), Women’s Track & Field (1), Women’s Swimming & Diving (1)
    • Used first UF concussion event only

  – Analysis using hierarchical regression and chi square associations for predictors of recovery time
• Methods and Study Design (cont.)
  
  – Primary *Variables* of Interest (predictors)
    
    • 1. Athletes who had *immediate* removal from activity (I-RFA)
      
      – *No* further hits or exertion
    
    • 2. Athletes who had *delayed* removal from activity (D-RFA)
      
      – *Any* further hits or exertion
    
  – Covariates: gender, concussion history, LD/ADHD diagnosis, psychiatric disorders, acute symptom severity
• Methods and Study Design (cont.)
  – Additional sample characteristics

<table>
<thead>
<tr>
<th></th>
<th>Total N = 97</th>
<th>LD/ADHD</th>
<th>Psychological Disorder</th>
<th>Prior Concussions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>Male</td>
<td>75</td>
<td>18/71</td>
<td>2/71</td>
<td>37/73</td>
</tr>
<tr>
<td>Female</td>
<td>22</td>
<td>9/22</td>
<td>6/21</td>
<td>10/22</td>
</tr>
<tr>
<td>Overall</td>
<td>97</td>
<td>27/93</td>
<td>8/92</td>
<td>47/95</td>
</tr>
<tr>
<td>Missing</td>
<td>0</td>
<td>4</td>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>

• Symptom severity at first evaluation of injury
  – PCSS (78), S3SE (18), missing (1)
  – Mean = 28.8 ± 18.5
  – Median time of assessment = 0.0 days (range 0-4)
• Methods and Study Design (cont.)
  – Primary Outcome Measures
    • The number of days between the concussion event and clearance for return to contact (Days Missed)
      – Days Missed was not affected by year concussion occurred
    • The likelihood of Prolonged (8 or more days) versus Normal (7 or fewer days) clearance for return to contact
      – Based on median days missed of 7 (range 3-67)
      – Blom normalization used
• Results
  – Fifty (51.5%) of the 97 athletes did not immediately report concussion symptoms (D-RFA).
  – D-RFA athletes averaged 4.9 more Days Missed than I-RFA athletes.
• Results (cont.)

– **D-RFA** athletes were **2.17 times more likely to have a prolonged recovery (≥ 8 days)** than **I-RFA athletes** ($\chi^2=10.268$, $p=.001$, $\varphi=.325$, medium effect size).

– **RFA group** significantly **predicted Days Missed** even after controlling for gender, concussion history, LD/ADHD diagnosis, psychiatric disorders, and acute symptom severity ($R^2_{\text{change}}=.097$, $\beta=.319$, $p=.002$).
Descriptive statistics and odds ratio analyses

In addition to table:
- LD/ADHD diagnosis and acute symptom severity also not predictive
- Psychiatric disorders predictive (2.1 x likely to have ≥8 day recovery) but under powered with only 8 concussions
Percentage of athletes cleared for return-to-contact over days missed based on removal from activity (RFA) group. Seven (7) days after injury, 72.3% of Immediate (I-RFA) athletes were cleared for return to play versus just 40% of Delayed (D-RFA) athletes. 100% of I-RFA athletes had achieved clearance by day 15, while 17% of D-RFA athletes required two weeks or longer before achieving Stage 5 of the Graduated Return to Play Protocol.
Conclusions

– A substantial number of athletes did not immediately recognize or report concussion symptoms.

– Athletes who did not immediately report concussion were at risk for protracted recovery.
• Discussion

  – Not engaging medical staff and continuing to participate in athletic activity during the immediate post-concussion period potentially exposed the already injured brain to additional neuronal stresses that could have compounded injury neuropathophysiologic processes.
Limitations

- This sample is overrepresented by males and football players.
- The study is limited to NCAA division 1 collegiate athletes and may not generalize to other age or competitive groups.
- It was also limited by its retrospective, cross-sectional design.
- Athletes who never reported their concussion are not accounted for.
• Future Directions
  – Replicate with larger sample and other groups
    • NCAA-DoD CARE data
      – Sport, gender, ADHD/LD, psychiatric disorder, concussion hx, etc.
      – Time of year (in vs. out of season)
      – Trends over time with increased awareness?
    • Intentional hiding or honest non-recognition?
  – Define window of vulnerability
    • How long?
    • Contact only or all activity?
  – Prospective design
Talking Points – Intuition Supported 😊

Public:
- In addition to never reporting, a lot of athletes delay reporting concussions.

Athletes:
- “Playing through it” ultimately results in more time away from sport.

Policy Makers:
- It is important for athletes to have someone to report to.
  - Athletic Trainers present at contact events
• Thank You