

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

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*original research*

# “Playing Through It”: Delayed Reporting and Removal From Athletic Activity After Concussion Predicts Prolonged Recovery

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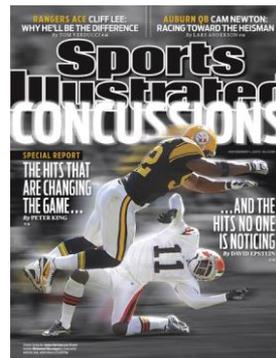
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**Context:** Preclinical research has demonstrated a window of vulnerability in the immediate aftermath of concussion wherein continued activity and stimulation can impair or prolong neurobehavioral recovery. However, this concept has not been quantified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

**Objective:** To examine the effect of delayed reporting and removal from athletic activity after concussion on recovery time

more days missed than the I-RFA athletes. Membership in the specific RFA group predicted days missed even after controlling for sex, concussion history, learning disability or attention-deficit/hyperactivity disorder diagnosis, diagnosed psychological disorder, and acute symptom severity ( $R^2$  change = 0.097,  $\beta$  = .319,  $P$  = .002). The D-RFA athletes were approximately 2.2 times more likely to have a prolonged recovery (8 or more days)

- 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= $20.4 \pm 1.3$  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



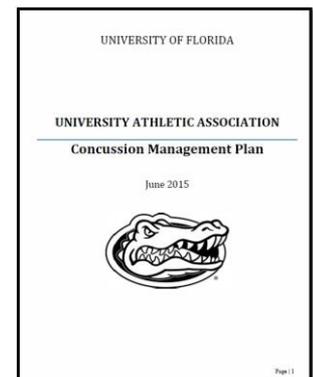
- Methods and Study Design (cont.)
  - Primary *Variables* of Interest (predictors)
    - 1. Athletes who had immediate removal from activity (I-RFA)
      - No further hits or exertion
    - 2. Athletes who had delayed removal from activity (D-RFA)
      - Any further hits or exertion
  - Covariates: gender, concussion history, LD/ADHD diagnosis, psychiatric disorders, acute symptom severity

- **Methods and Study Design (cont.)**
  - Additional sample characteristics

	Total N = 97	LD/ADHD	Psychological Disorder	Prior Concussions		
				0	1	2+
Male	75	18/71	2/71	37/73	28/73	8/73
Female	22	9/22	6/21	10/22	8/22	4/22
Overall	97	27/93	8/92	47/95	36/95	12/95
Missing	0	4	5		2	

- 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 ( $\geq 8$  days)** than I-RFA athletes ( $\chi^2=10.268$ ,  $p=.001$ ,  $\phi=.325$ , 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 ( $R^2\text{change}=.097$ ,  $\beta=.319$ ,  $p=.002$ ).

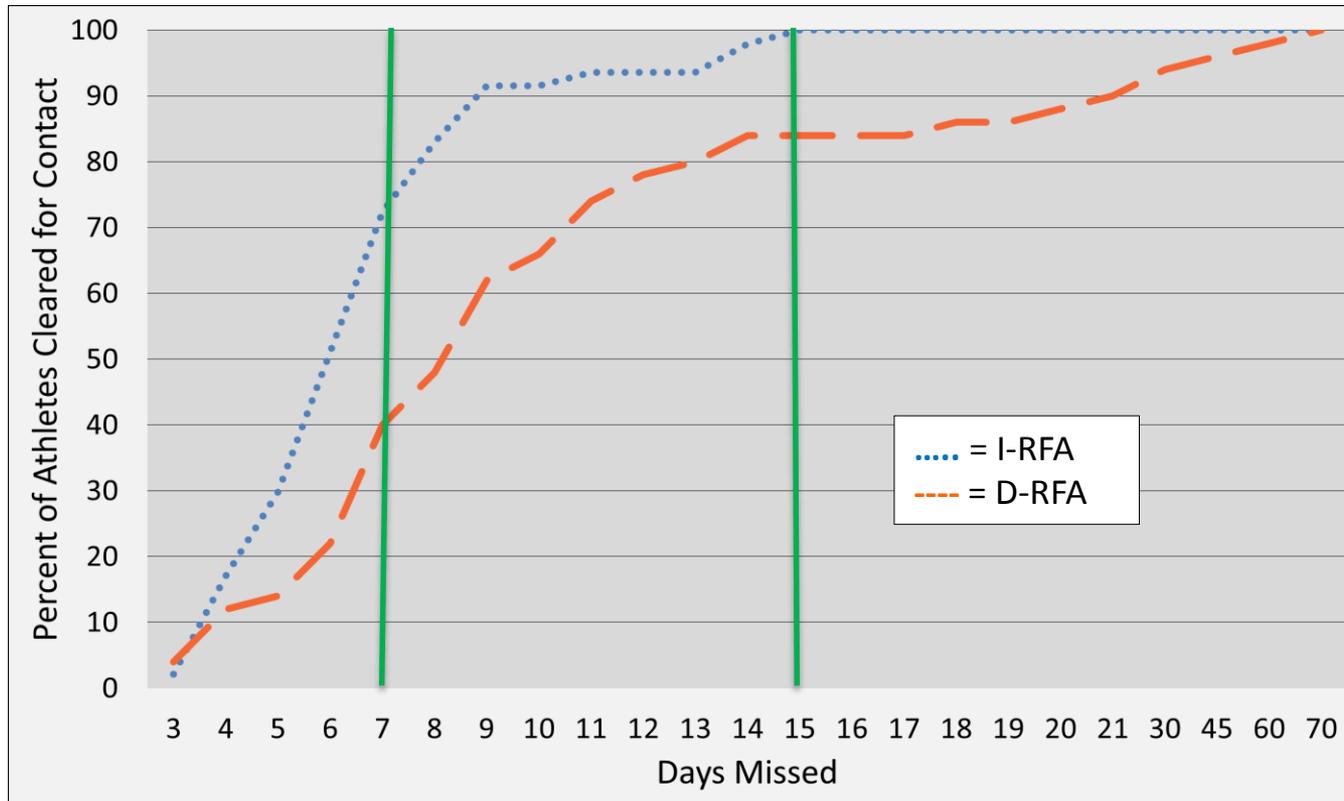


- Descriptive statistics and odds ratio analyses

	N	Days Missed	Recovery Length		Activity Type		Concussion History			Sex	
			Prolonged	Odds Ratio	Game	Odds Ratio	0	1	2+	Male	Odds Ratio
		Mean (SD)	%		%		%			%	
<b>Total</b>	97	9.6 (9.3)	44.3		22.7		49.5	37.9	12.6	77.3	
							X <sup>2</sup> =.455, p=.846				
<b>I-RFA</b>	47	6.8 (2.6)	27.7	2.17*	27.7	1.54	48.9	40.4	10.6	70.2	1.20
				p=.001							
<b>D-RFA</b>	50	12.3 (12.2)	60.0		18.0		50.0	35.4	14.6	84.0	

– 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

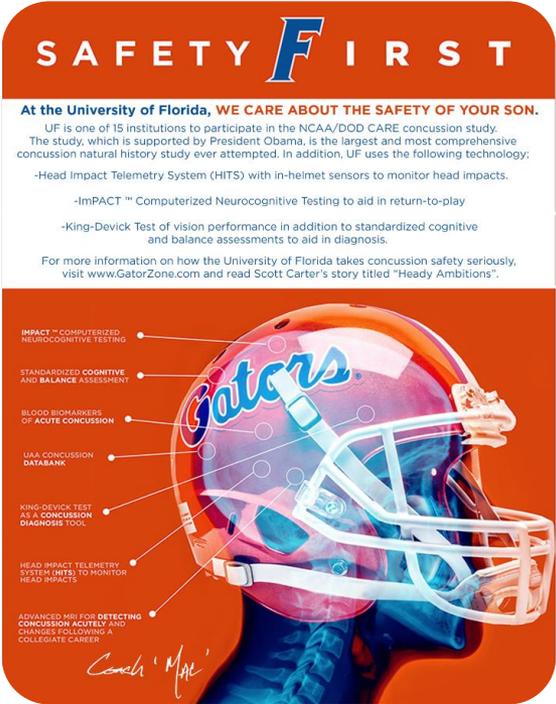


Percentage of athletes cleared for return-to-contact over days missed based on removal from activity (RFA) group. Seven (7) days after injury, 72.3% of Immediate (I-RFA) athletes were cleared for return to play versus just 40% of Delayed (D-RFA) athletes. 100% of I-RFA athletes had achieved clearance 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.



**SAFETY FIRST**

**At the University of Florida, WE CARE ABOUT THE SAFETY OF YOUR SON.**

UF is one of 15 institutions to participate in the NCAA/DOD CARE concussion study. The study, which is supported by President Obama, is the largest and most comprehensive concussion natural history study ever attempted. In addition, UF uses the following technology:

- Head Impact Telemetry System (HITS) with in-helmet sensors to monitor head impacts.
- ImPACT™ Computerized Neurocognitive Testing to aid in return-to-play
- King-Devick Test of vision performance in addition to standardized cognitive and balance assessments to aid in diagnosis.

For more information on how the University of Florida takes concussion safety seriously, visit [www.GatorZone.com](http://www.GatorZone.com) and read Scott Carter's story titled "Heady Ambitions".

IMPACT™ COMPUTERIZED NEUROCOGNITIVE TESTING

STANDARDIZED COGNITIVE AND BALANCE ASSESSMENT

BLOOD BIOMARKERS OF ACUTE CONCUSSION

UF's CONCUSSION DATABASE

KING-DEVICK TEST AS A CONCUSSION DIAGNOSIS TOOL

HEAD IMPACT TELEMETRY SYSTEM (HITS) TO MONITOR HEAD IMPACTS

ADVANCED HIRTS FOR DETECTING CONCUSSION ACUTELY AND CHANGES FOLLOWING A COLLEGIATE CAREER

Coach 'Mae'

- 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

