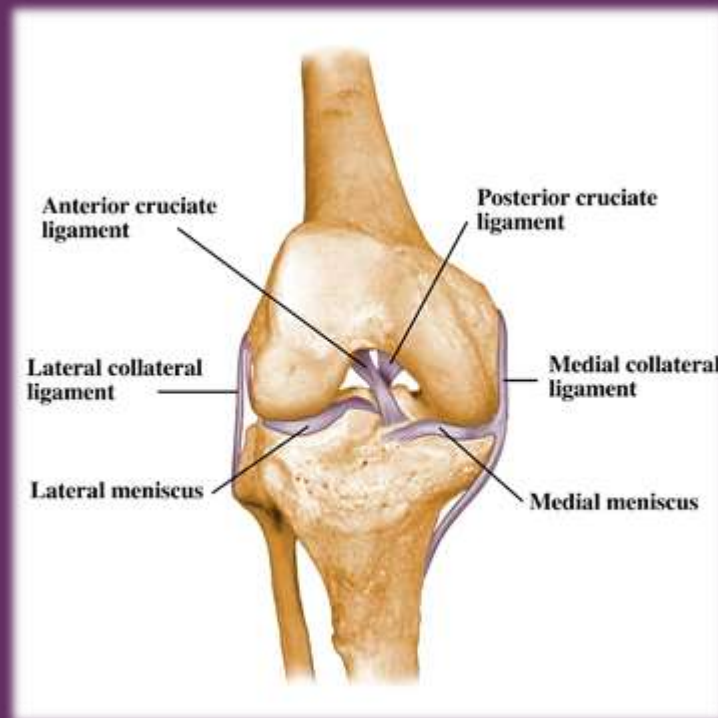


# The effects of specific signal forewarning on ACL loading factors and performance in an unanticipated jump landing

Taylour Hinshaw

# Introduction

- ▶ The anterior cruciate ligament (ACL)



# ACL Injury Pandemic

- ▶ Anterior cruciate ligament (ACL) injuries pervasively common
  - ▶ Major load on healthcare system (Hootman et al, 2007; Hewett et al, 2007; Brophy et al, 2009)
- ▶ ACL reconstruction
  - ▶ Not particularly effective (Kamath et al, 2010)
  - ▶ Post-reconstruction performance low (Busfield et al, 2009)

# Prevention

- ▶ 70% of ACL injuries are non-contact (Boden et al, 2000)
- ▶ Prevention through intervention training

# Testing Methodologies

- ▶ Perhaps lab testing lacking dynamic nature of sport performance?
- ▶ Previous literature introduced unanticipated testing conditions
  - ▶ Resulted in increases in ACL loading factors  
(Sell et al, 2006; Borotikar et al, 2008; Fong et al, 2014)

# Refinement in Process

- ▶ Lack of stimulus timing quantification in classically unanticipated (CU) research
  - ▶ Flawed unanticipated assumption?
- ▶ Research indicates LE pre-motor activation times of ~300-500ms  
(McLean et al, 2010)

# Timed Unanticipated

- ▶ Recent timed-stimuli research investigated stimuli 600-400ms before landing (Brown et al, 2009)
  - ▶ Found no differences in timed unanticipated (TU) conditions
  - ▶ Did not investigate critical window

# Current Direction

- ▶ Current research will investigate the effects of manipulating stimuli timing at five specific points
  - ▶ Anticipated (AN), classically unanticipated (CU), timed unanticipated at 300ms (TU300) and 150ms (TU150) before landing, and at landing (LA).



# Purpose

- ▶ Investigating effects of stimulus timing 0ms to 400ms before landing necessary
- ▶ Hypothesized that ACL loading factors would increase and performance would decrease as time to react decreased

# Participants

- ▶ 21 uninjured volunteers (8F, 13 M;  $22 \pm 4$  years;  $1.74 \pm 0.08$  m;  $72 \pm 16$  kg)
- ▶ Provided consent and performed warm-up

# Protocol



# Protocol



# Protocol

- ▶ Participants performed 45 jump trials:
  - ▶ Three jumps in three directions per stimulus timing:  
Anticipated (AN), instant of takeoff (CU),  
300ms prelanding (TU300), 150ms prelanding  
(TU150), and at landing (LA)

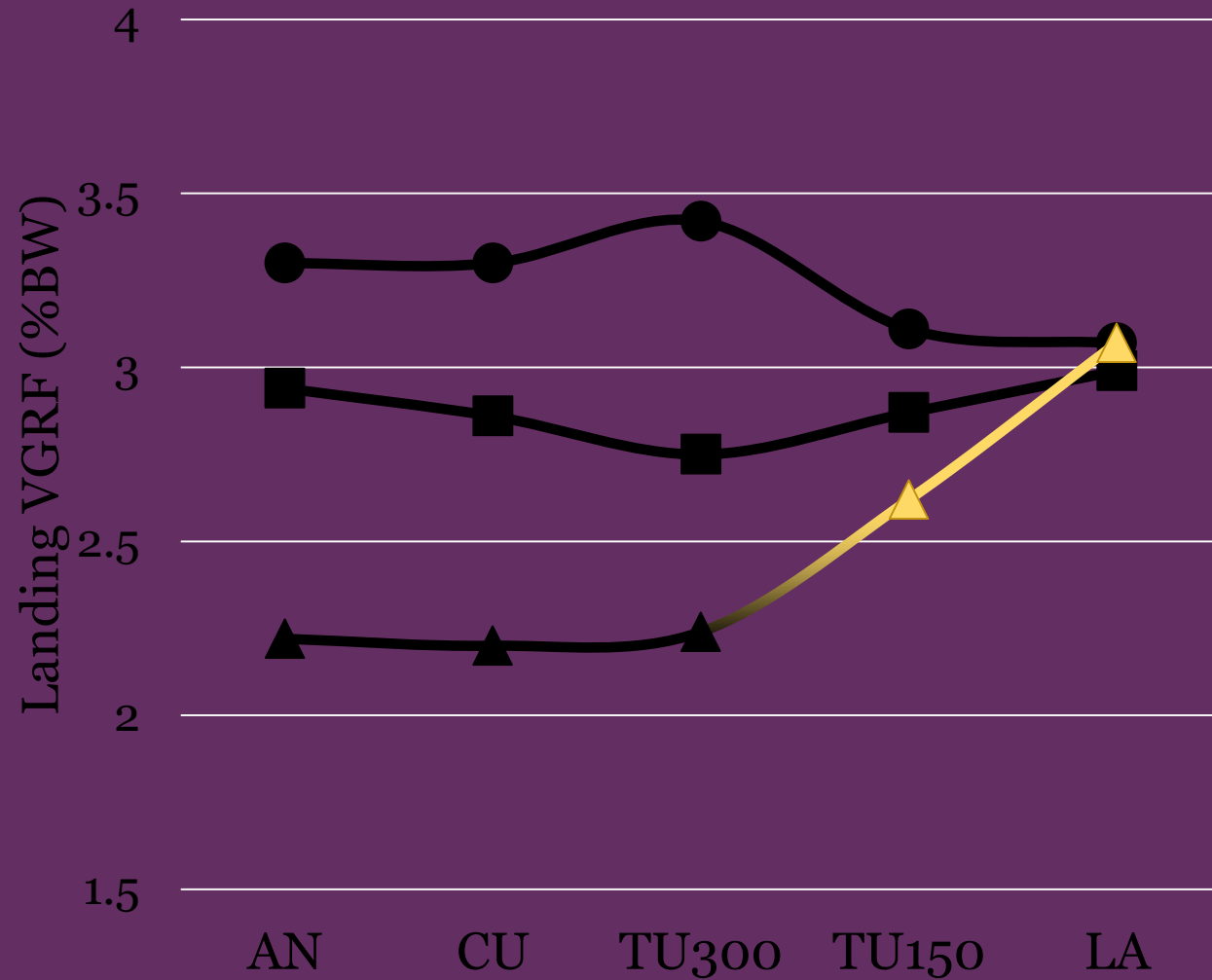
# Data Reduction

- ▶ Kinetic analysis
  - ▶ Injury variables
    - ▶ Peak impact Fz
  - ▶ Performance variables
    - ▶ Peak jump Fz
    - ▶ Contact time (CT)

# Statistics

- ▶ Repeated measures ANOVA
  - ▶ Time conditions (5) and jump direction (3)
  - ▶ Post-hoc ANOVA -> paired t-tests
  - ▶ Alpha value = 0.05

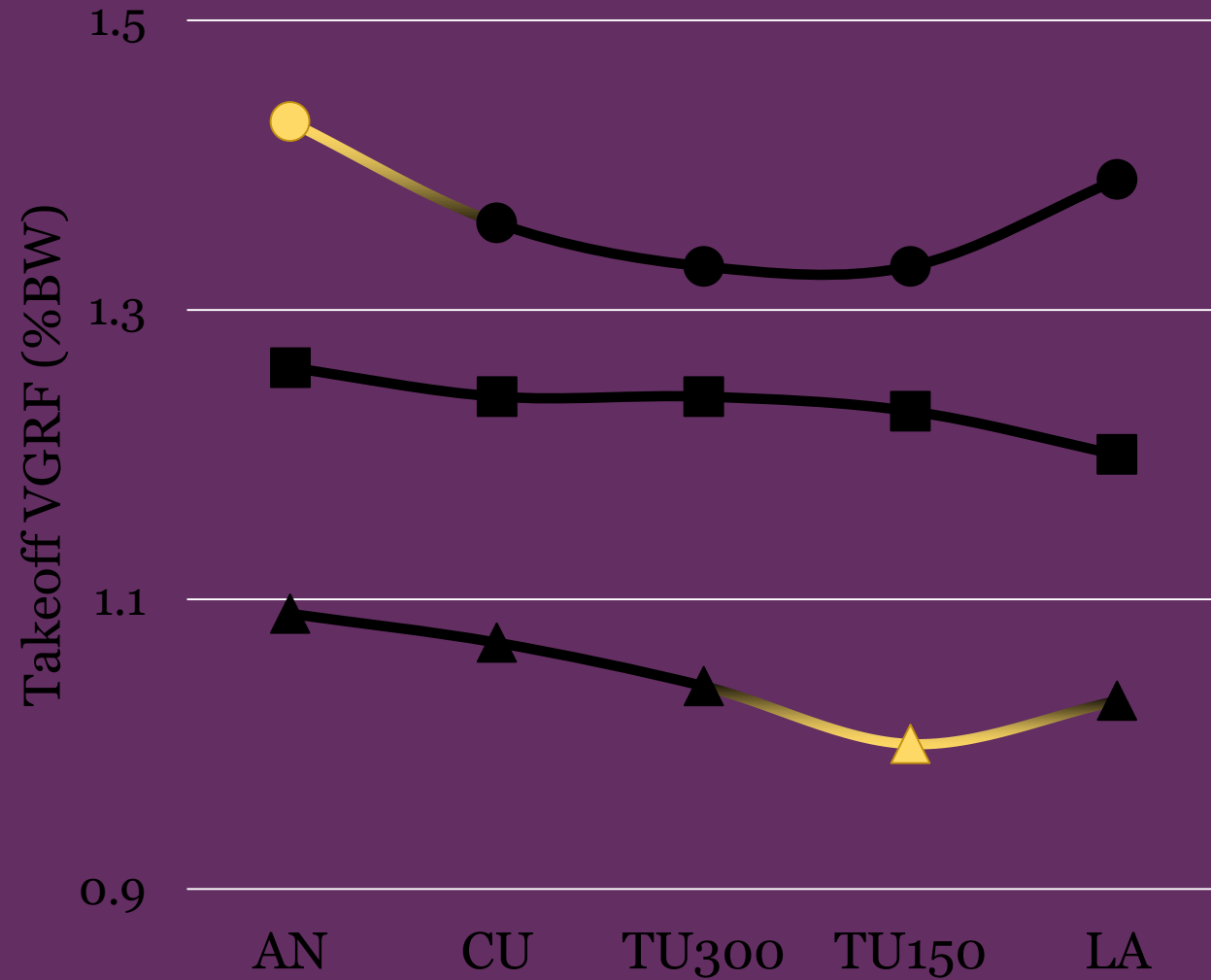
# Impact Fz



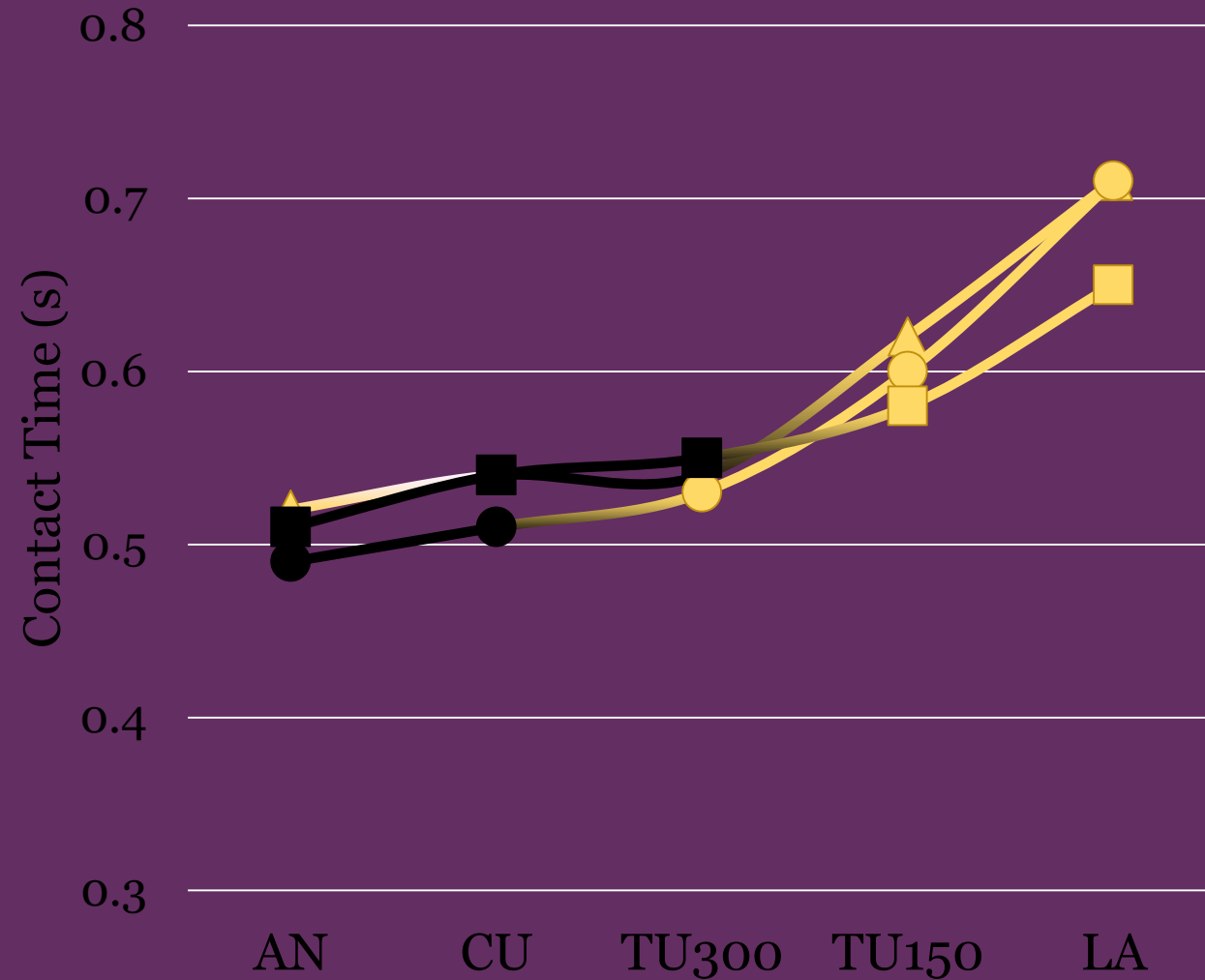
Circle- medial  
Square- jump up  
Triangle- lateral



# Jump Fz



# Contact Time



Circle- medial  
Square- jump up  
Triangle- lateral

# Results Related to Previous Literature

- ▶ Detected significant change in CT
  - ▶ Previous investigations did not analyze performance variables (Brown et al, 2009)
- ▶ No difference in AN and CU conditions
  - ▶ Unlike majority of previous literature (Sell et al, 2006; Borotikar et al, 2008; Fong et al, 2014)

# Limitations

- ▶ Incomplete sample
- ▶ Basic investigation on limited variables

# Future Direction

- ▶ Complete full analysis
- ▶ Results may indicate timing cutoff
  - ▶ Changes in future methodology

# Take-Home Message

- ▶ Individuals working with athletes should focus on maximizing performance after 300 ms cutoff while still decreasing injury factors

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