The background of the slide features a large, faint watermark of the University of Delaware seal. The seal is circular and contains the text 'UNIVERSITY OF DELAWARE' around the perimeter. In the center, there are two open books. The left book is labeled 'GRAMM', 'PHILOL', 'RHETOR', and 'ETHIC'. The right book is labeled 'METAPH', 'LOGIC', and 'MATHEM'.

# Are There Limb-to-Limb Differences in Knee and Hip Kinematics between Collision, Contact, and Non-Contact Sport Athletes One Year After ACLR?

Amelia Arundale, PT, DPT, SCS

Lynn Snyder-Mackler, PT, ATC, Sc.D, SCS, FAPTA



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# Introduction

Categorization of sports is a common way of assessing the risk of bodily harm associated with participation<sup>(Rice 2008)</sup>

- **Examples:**

- **Collision:** Football, Rugby, Aussie Rules Football, Ice Hockey, Boxing, Men's Lacrosse,
- **Contact:** Soccer, Basketball, Women's Lacrosse, Field Hockey, Ultimate Frisbee,
- **Limited Contact:** Baseball, Softball, Volleyball, Squash, Flag Football, Martial Arts,
- **Non-contact:** Tennis, Golf, Track/Running, Swimming

# Introduction

- Anterior cruciate ligament (ACL) injuries are common in cutting/pivoting sports. (Prodromos 2007)
- Collision sports, American football in particular, have high rates of ACL injuries, (McCullough 2012, Comstock 2013) subsequent ACL injuries, (Comstock 2013) and early onset-osteoarthritis. (Moretz 1984, Golightly 2009)
- The rate of return to sport in American football is similar to that of other sports, (McCullough 2012, Ardern 2014) however return to sport in itself is a risk factor for secondary ACL injury. (Ardern 2014, Paterno 2010)
- Asymmetries still exist at one and two years after ACL reconstruction (ACLR), (Di Stasi 2013, Roewer 2011)
- However to the authors knowledge there is no research on if there are particular differences between athletes of different sports, such as high risk collision sports.

The purpose of this study was to examine limb-to-limb differences in knee and hip kinematics and kinetics between collision, contact, limited contact, and non-contact sport athletes who have returned to their prior level of activity at one year after ACLR.

# Methods

- 35 cutting/pivoting sport athletes (25 male, 10 female) who had returned to their prior level of activity were tested one year after ACLR.
- Subjects were classified as Collision (COL), Contact (CON), Limited Contact (LCON), and Non-Contact (NCON), based on their sport of injury.
- Motion analysis was performed examining hip and knee angles and moments in the sagittal and frontal planes at initial contact.
- Limb-to-limb differences were calculated by subtracting the uninvolved limb angle/moment from the involved limb angle/moment
- A MANOVA with pairwise comparison was used to determine if there were differences between groups in kinematic and kinetic limb-to-limb difference variables.
- Significance was set *a priori* at  $p \leq 0.05$ .

# Results

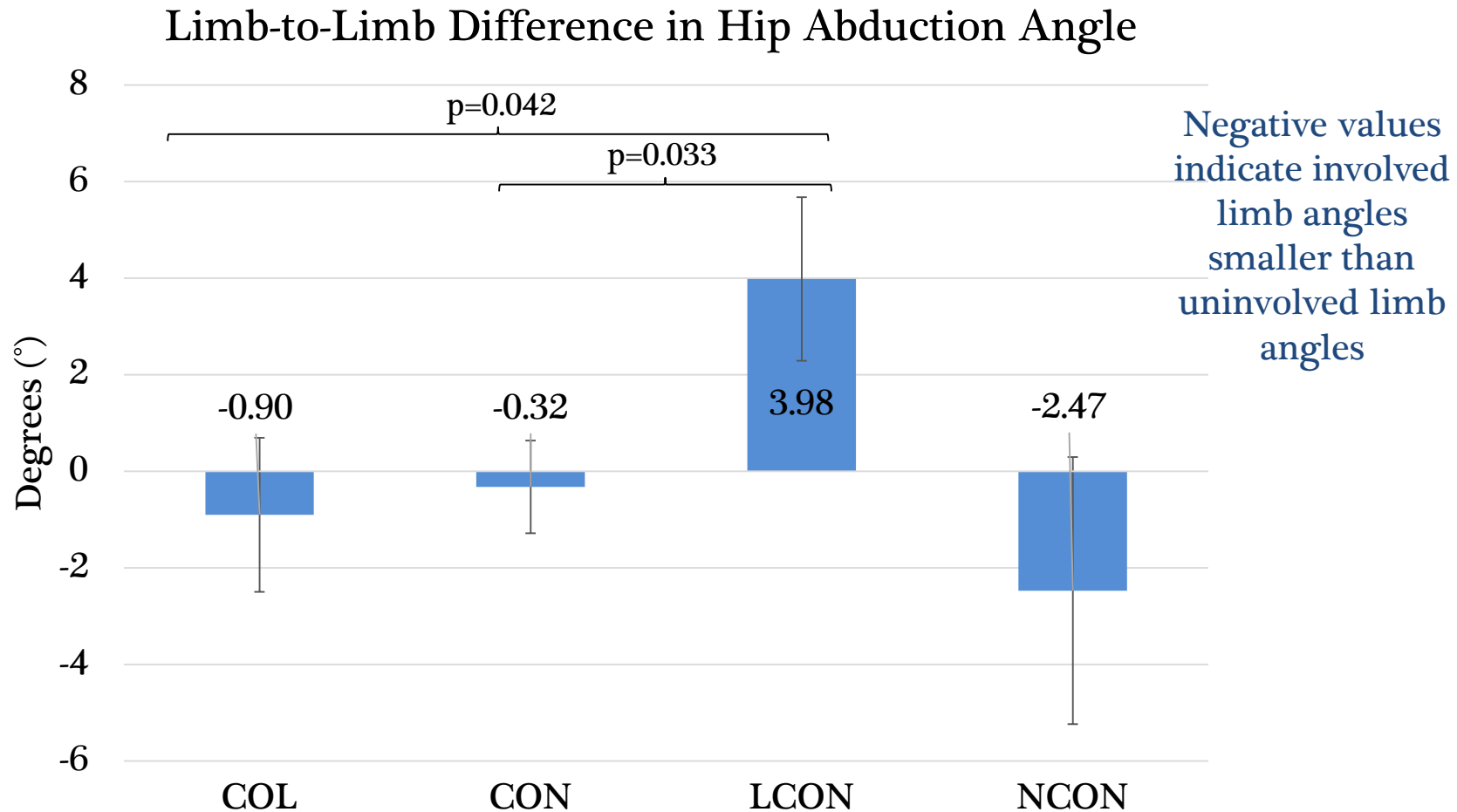
- No significant differences between groups

Kinematics	p-value
Hip Flexion Angle	0.383
Hip Adduction Angle	0.099
Knee Flexion Angle	0.127
Knee Abduction Angle	0.834

Kinetics	p-value
Hip Flexion Moment	0.917
Hip Adduction Moment	0.701
Knee Flexion Moment	0.327
Knee Abduction Moment	0.169

# Results

## Significant differences in pairwise comparisons of hip adduction angle limb-to-limb difference

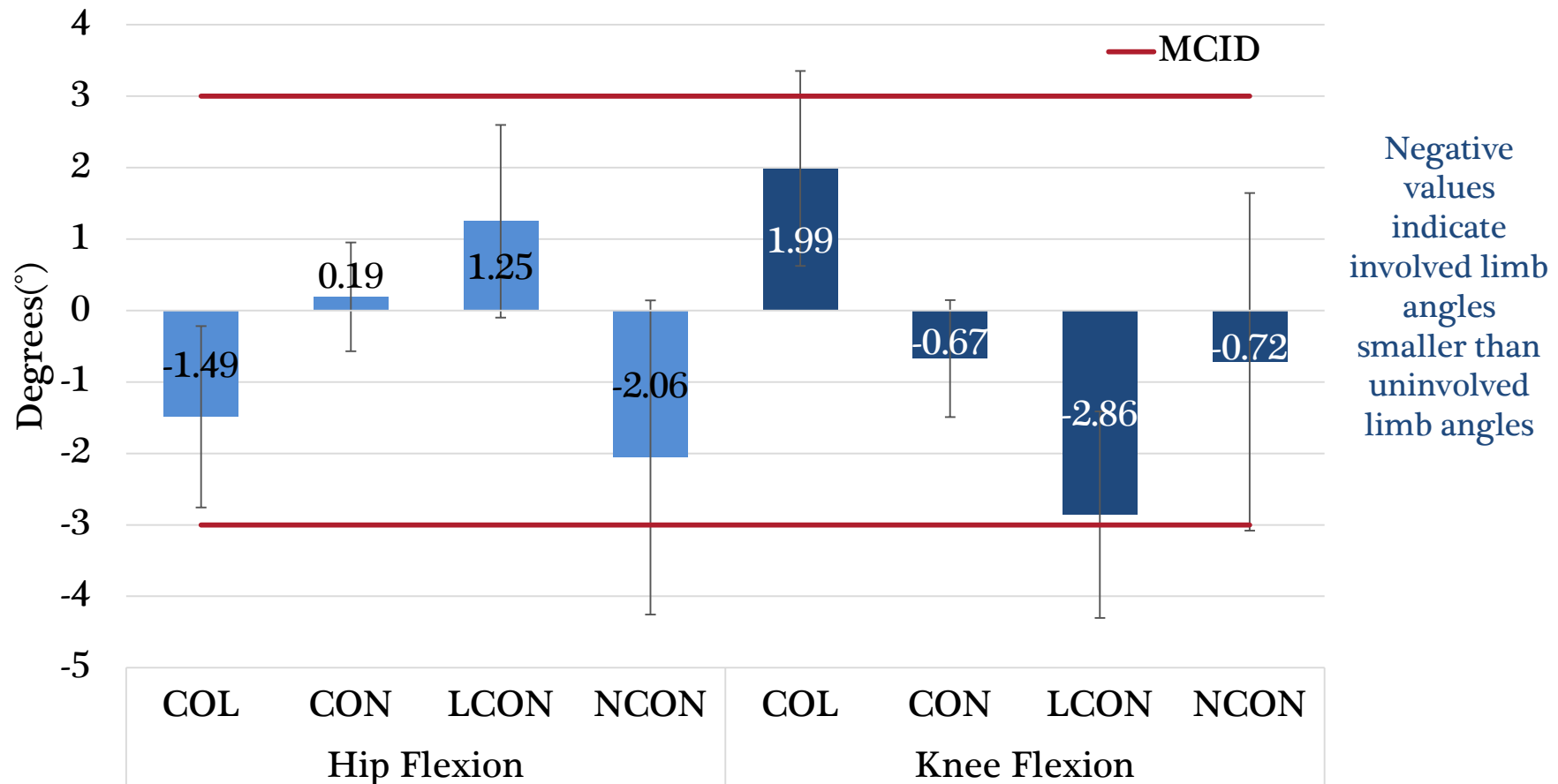




# Results

All groups have limb-to-limb differences in hip and knee flexion angles smaller than the MCID (Di Stasi 2012)

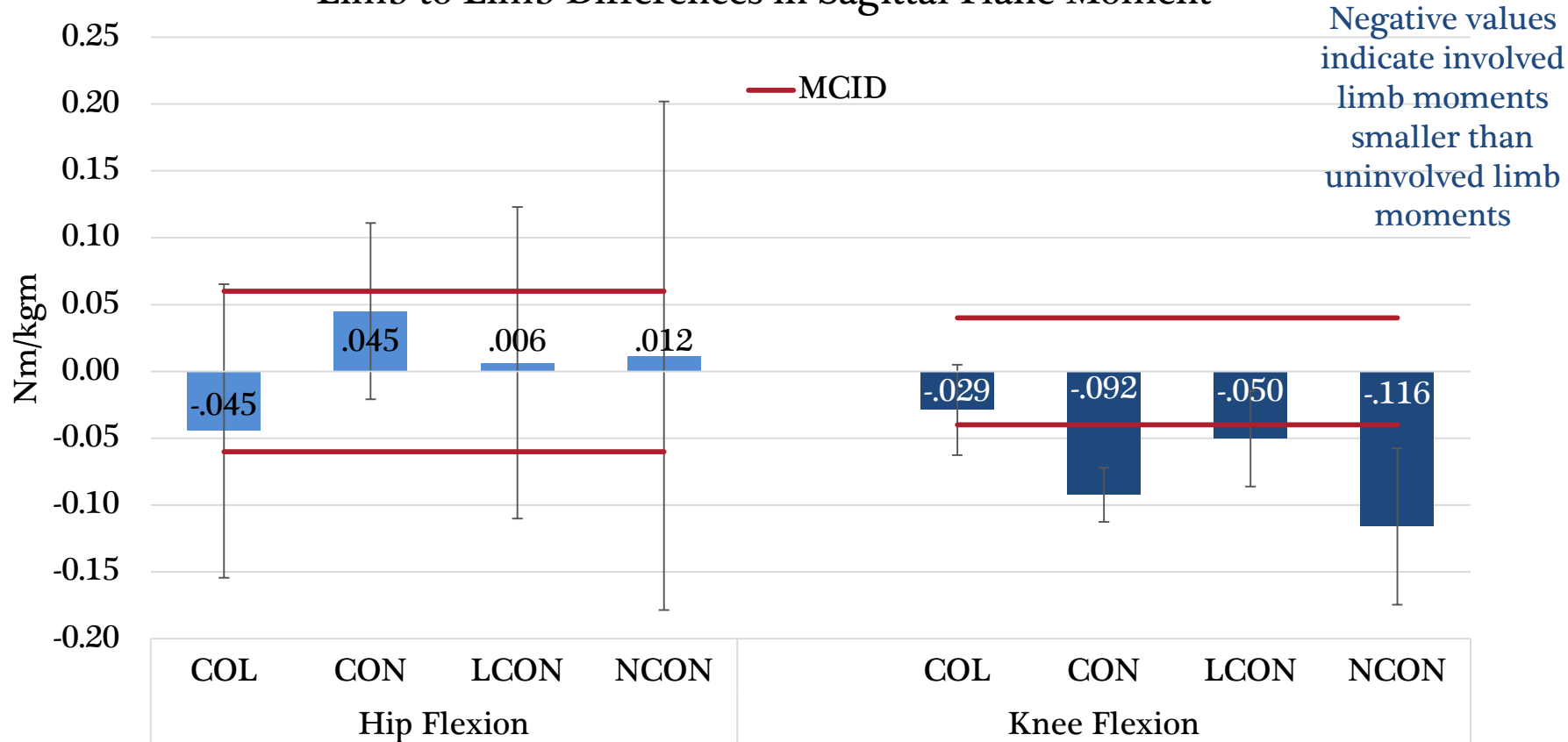
Limb-to-Limb Differences in Saggital Plane Angle



# Results

CON, LCON, and NCON groups have knee flexion moment limb-to-limb differences larger than the minimal clinically important difference. (Di Stasi 2012)

Limb-to-Limb Differences in Sagittal Plane Moment



## Discussion

- No significant differences between groups
  - Pairwise comparison found LCON significantly different from COL and CON groups in hip adduction angle
    - LCON only group to have larger angle on involved limb
  - Sport categorization may not be useful in identifying groups of athletes with larger limb-to-limb differences
- Limb asymmetries may place an athlete at risk for secondary ACL injury (ipsi- or contralateral) (Paterno 2010, Hewett 2013)
  - CON, LCON, and NCON groups have knee flexion moment limb-to-limb differences exceeding the MCID
    - These differences exist even though all athletes had returned to their pre-injury level of activity

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