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# Speed and Surface Speed and Magnitude of Knee Adduction

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## Abstract

Frontal plane knee biomechanics, in particular speed and magnitude of knee adduction motion, are implicated in knee osteoarthritis development. Although individuals are between 50% to 90% more likely to develop knee osteoarthritis after anterior cruciate ligament reconstruction (ACL-R), it is unknown if ACL-R individuals exhibit knee adduction biomechanics related to OA development. This study sought to quantify speed and magnitude of knee adduction for knee OA and ACL-R individuals. We hypothesize that OA will exhibit larger, faster knee adduction biomechanics than ACL-R, which will increase at great walk speed and over a challenging surface. Six individuals with ACL-R and 8 individuals with knee OA had knee adduction quantified as they walked 1.3 m/s and at a self-selected speed over a flat and an uneven surface. Peak of stance, and average and maximum velocity of knee adduction joint angle and moment between heel strike and peak of stance were submitted to repeated measures ANOVA to compare main and interaction effects between group, speed and surface. There was a walk speed by group interaction for peak knee adduction moment ($p = 0.048$). Walk speed impacted maximum knee adduction joint angle ($p=0.004$) and moment velocity ($p=0.041$), while surface impacted peak knee adduction joint angle ($p=0.035$) and maximum knee adduction joint moment velocity ($p=0.007$). In partial agreement with our hypothesis, speed and magnitude knee adduction biomechanics increased with walk speed and surface, but OA did not consistently exhibit larger knee adduction biomechanics than ACL-R.

# SPEED AND SURFACE SPEED AND MAGNITUDE OF KNEE ADDUCTION

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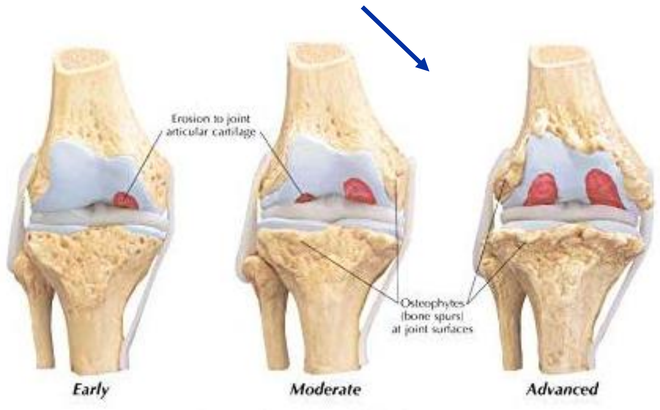
## INTRODUCTION

Frontal plane knee biomechanics are **implicated in cartilage destruction** that knee osteoarthritis (OA).




After anterior cruciate ligament reconstruction (ACL-R) individuals are up **90% more likely to develop knee OA**.

**Gap in knowledge:** it is unknown if ACL-R individuals exhibit increases in speed and magnitude of knee adduction biomechanics related to OA development

**Purpose:** to quantify speed and magnitude of knee adduction biomechanics for individuals with ACL-R and knee OA.

## METHODS

### Participants:

ACL-R (N = 6)

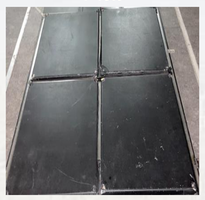
OA (N = 8)

Each participant had knee adduction quantified as they walked 1.3 m/s and at a self-selected speed over a flat and an uneven surface.

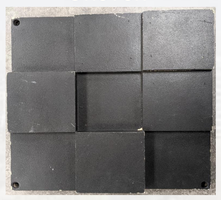
### Surfaces:

Each surface was secured atop the force platform with a metal frame.

Flat



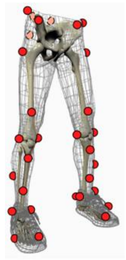
Uneven



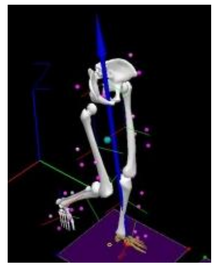
## METHODS

### Biomechanical Analysis:

**Motion Capture**



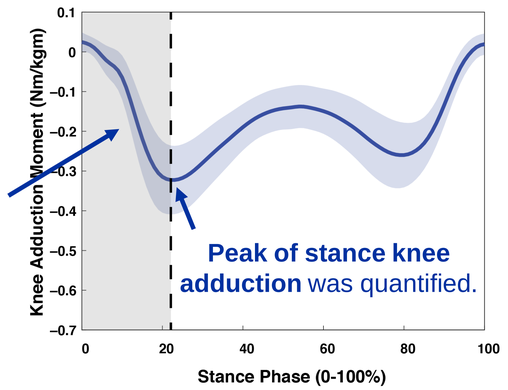
**Frontal Plane Biomechanics**



Synchronous 3D marker trajectories and GRF data were recorded with motion capture and processed in Visual3D to obtain frontal plane biomechanics.

### Knee Adduction Biomechanics:

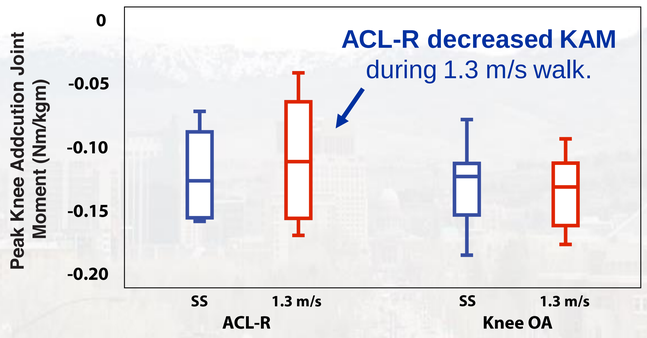
**Average and max** knee adduction velocity between heel strike and peak was quantified.




**Peak, and avg / max velocity** of knee adduction joint angle (KAA) and moment (KAM**)** were submitted to RM ANOVA.

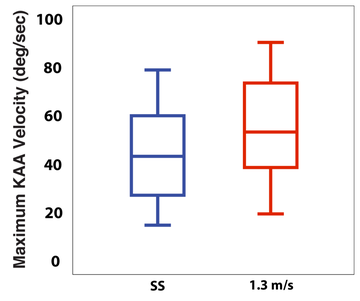
## RESULTS

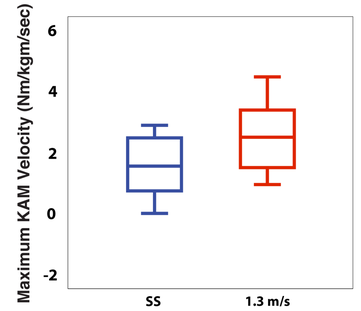
A significant speed by group interaction for peak knee adduction moment (p = 0.048) was observed.




## RESULTS

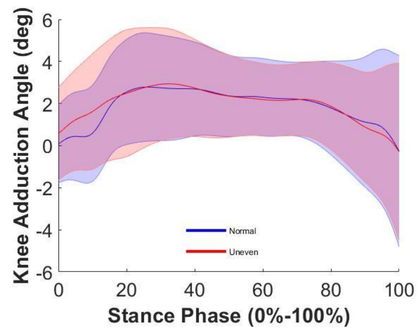
Speed impacted max KAA (p=0.004) and KAM velocity (p=0.041).



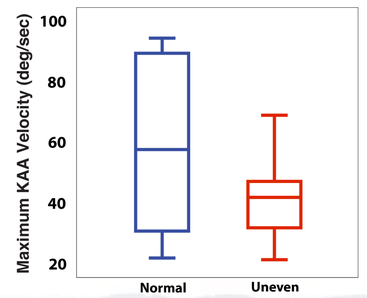

Max KAA and KAM **increased 25% and 99%** during 1.3 m/s walk.

Surface impacted peak KAA (p=0.035) and max KAA velocity (p=0.007).




Peak KAA was **10% larger** on the uneven surface.

Max KAA was **27% smaller** on the uneven surface.




**KEY FINDINGS:**

Speed and magnitude of knee adduction increased with walk speed and surface.

OA did not consistently exhibit higher knee adduction biomechanics than ACL-R

## ACKNOWLEDGEMENTS

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