

# IMPACT OF KNEE INJURY AND DISEASE ON FRONTAL PLANE KNEE BIOMECHANICS DURING WALK ON UNEVEN SURFACES



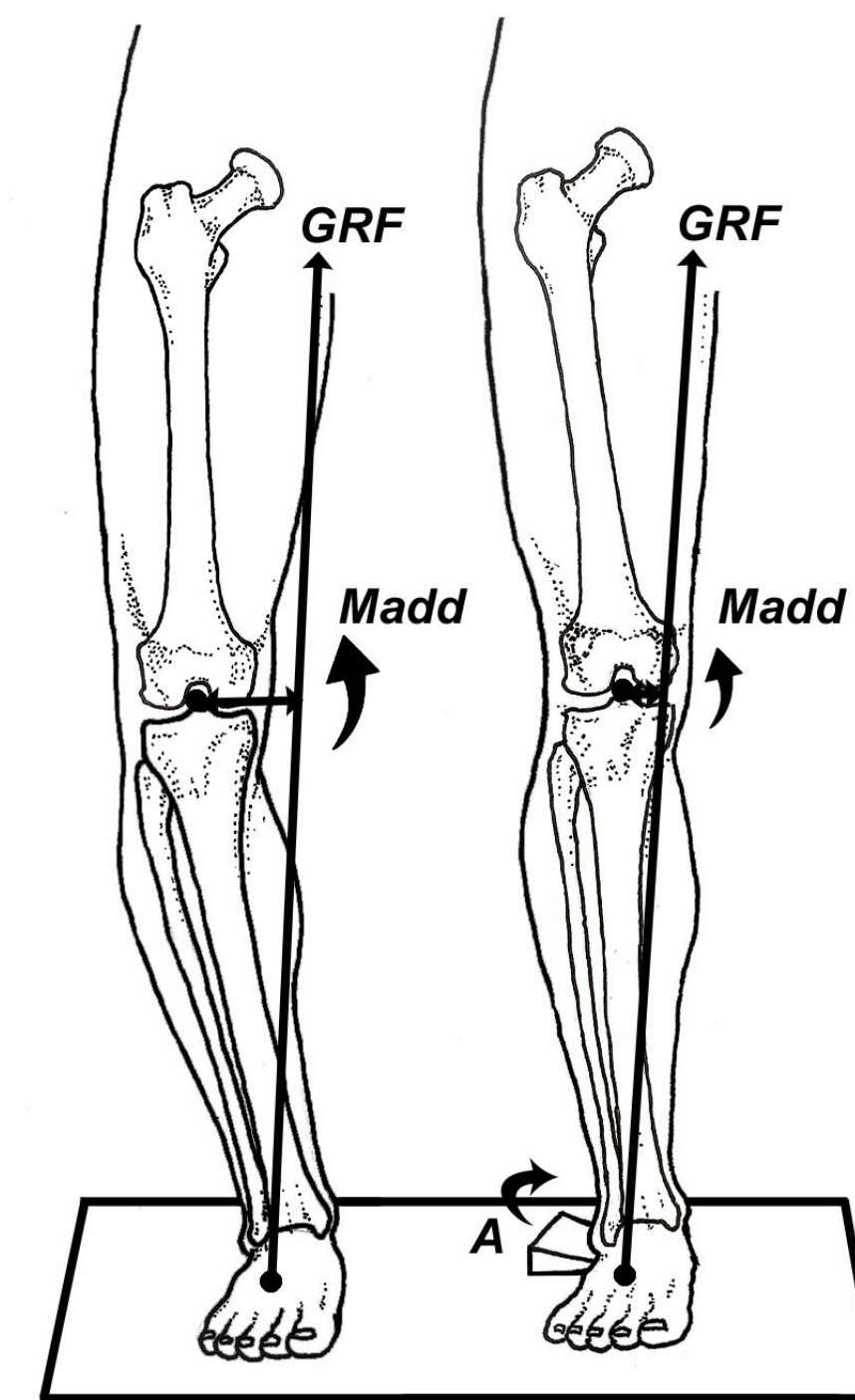
Mason D. Shaffer, Nicholas L. Hunt, Matthew V. Robinett & Tyler N. Brown  
Center for Orthopaedic and Biomechanics Research, Boise State University, Boise, ID

## INTRODUCTION

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

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

**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)

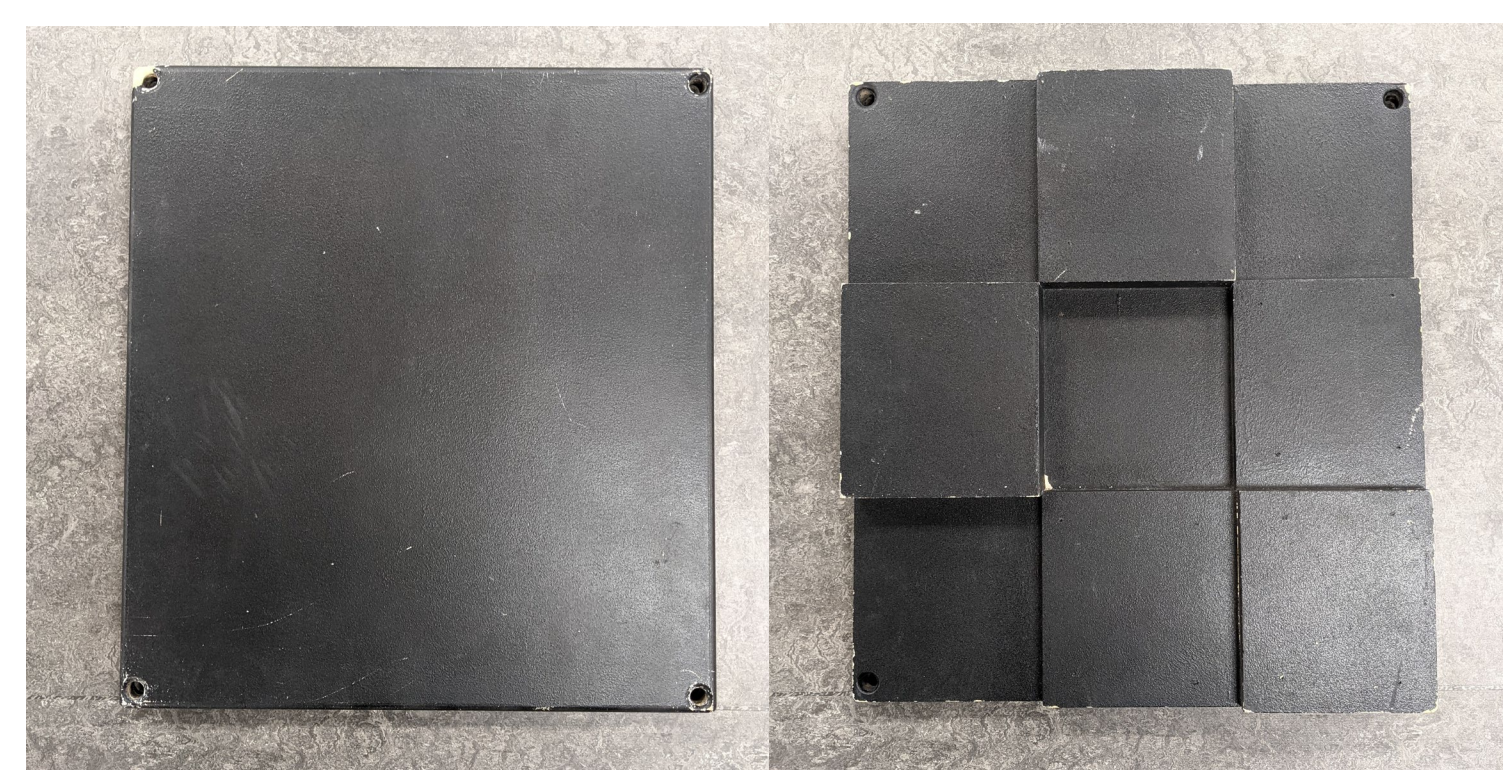


Age, height, and weight data was taken before to normalize findings.

### Task:

Flat Uneven

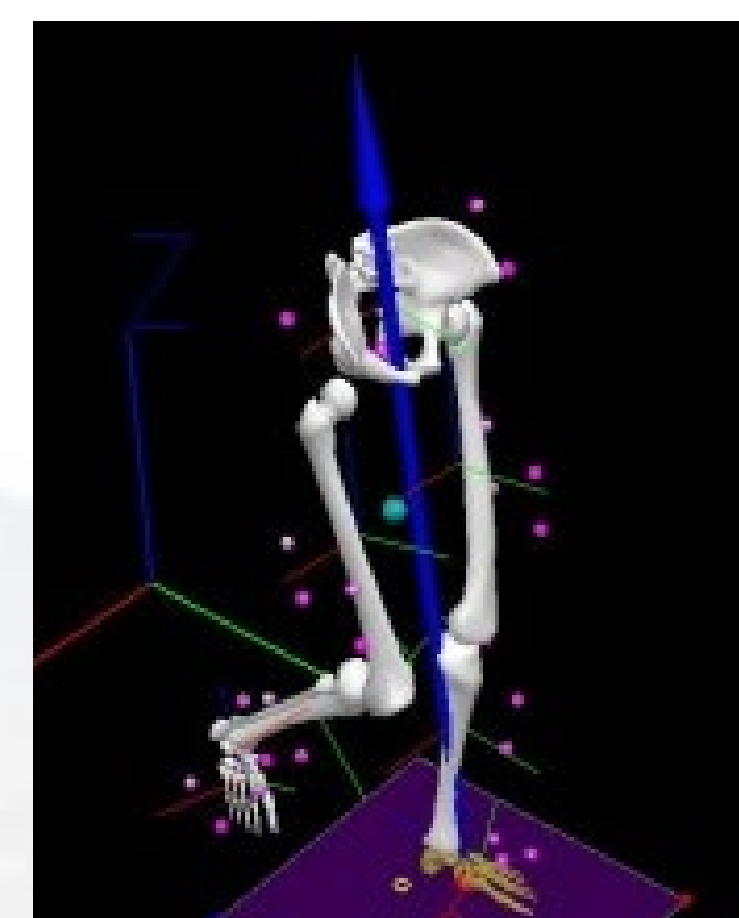
Each participant had knee adduction quantified as they walked 1.3 m/s and at a self-selected speed over a flat and an uneven surface.



### Biomechanical Analysis:

#### Motion Capture

#### Frontal Plane Biomechanics



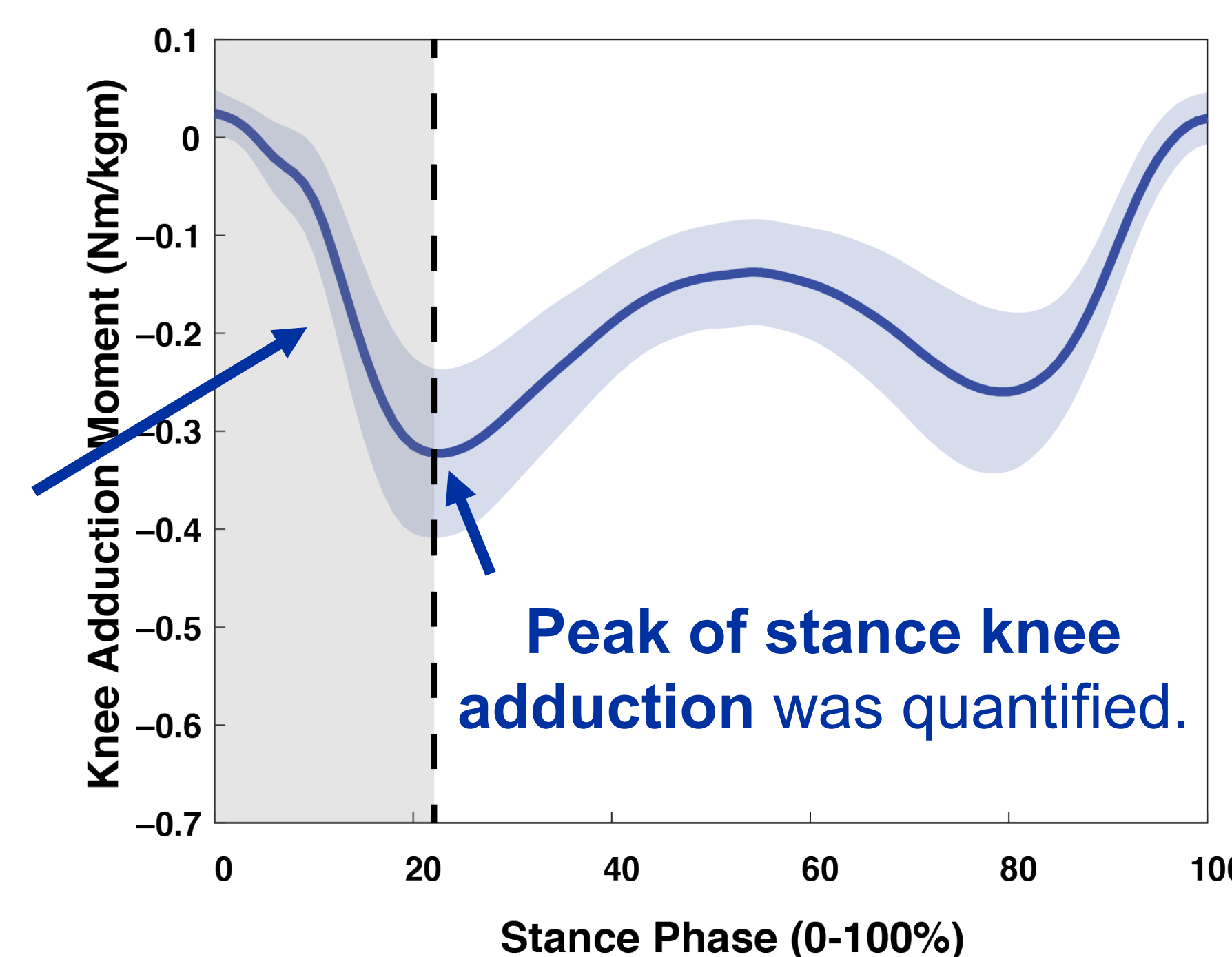
1. KA angle
2. KA for surfaces
3. Moment speeds
4. Moment

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

## METHODS

### Knee Adduction Biomechanics:

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



### Statistical Analysis:

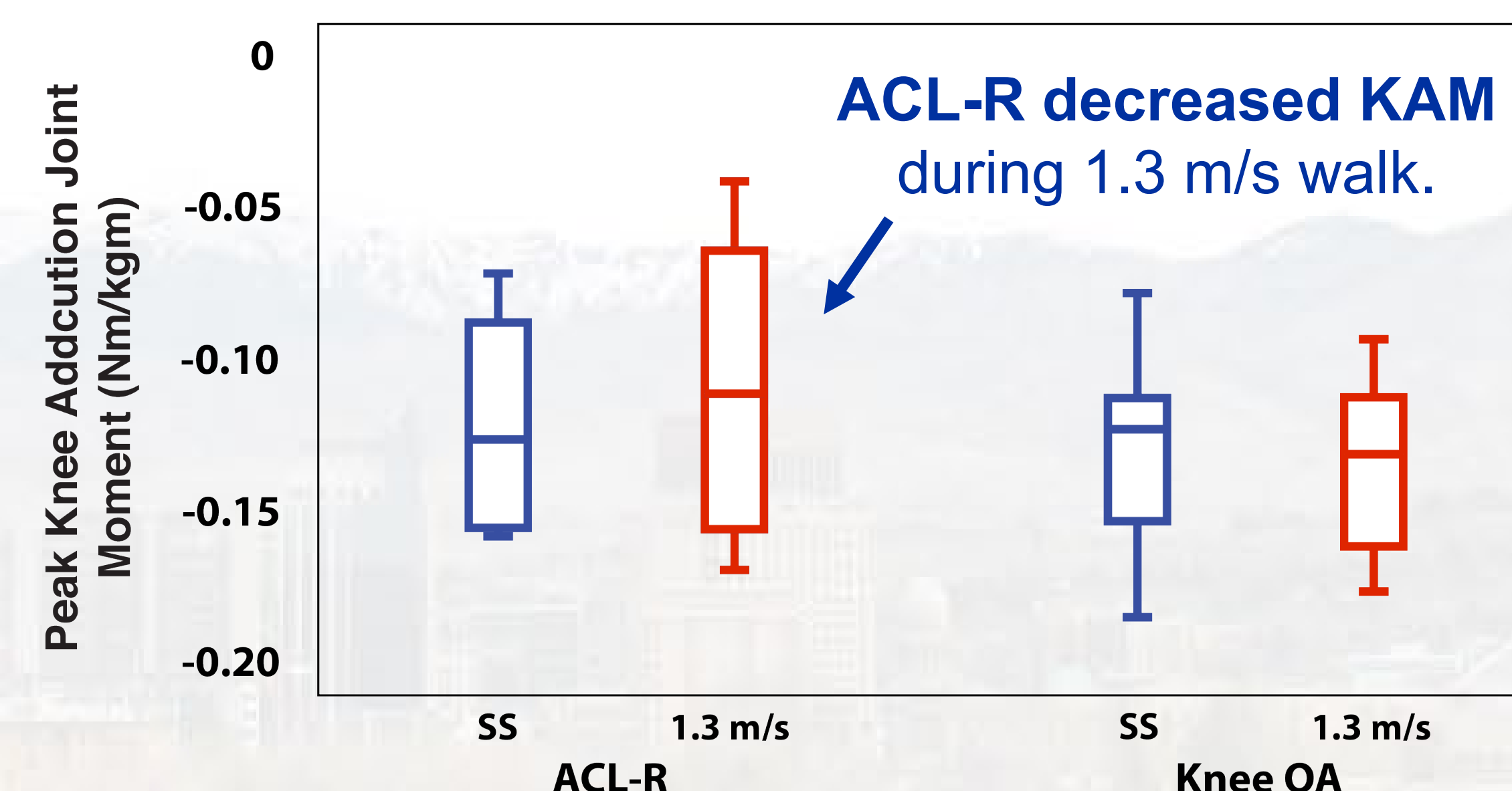
Knee Adduction Joint Angle  
Knee Adduction Moment  
Speed of Participant Movement  
Flat/Uneven Surface

2-Model ANOVA  
( $p < 0.05$ )

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

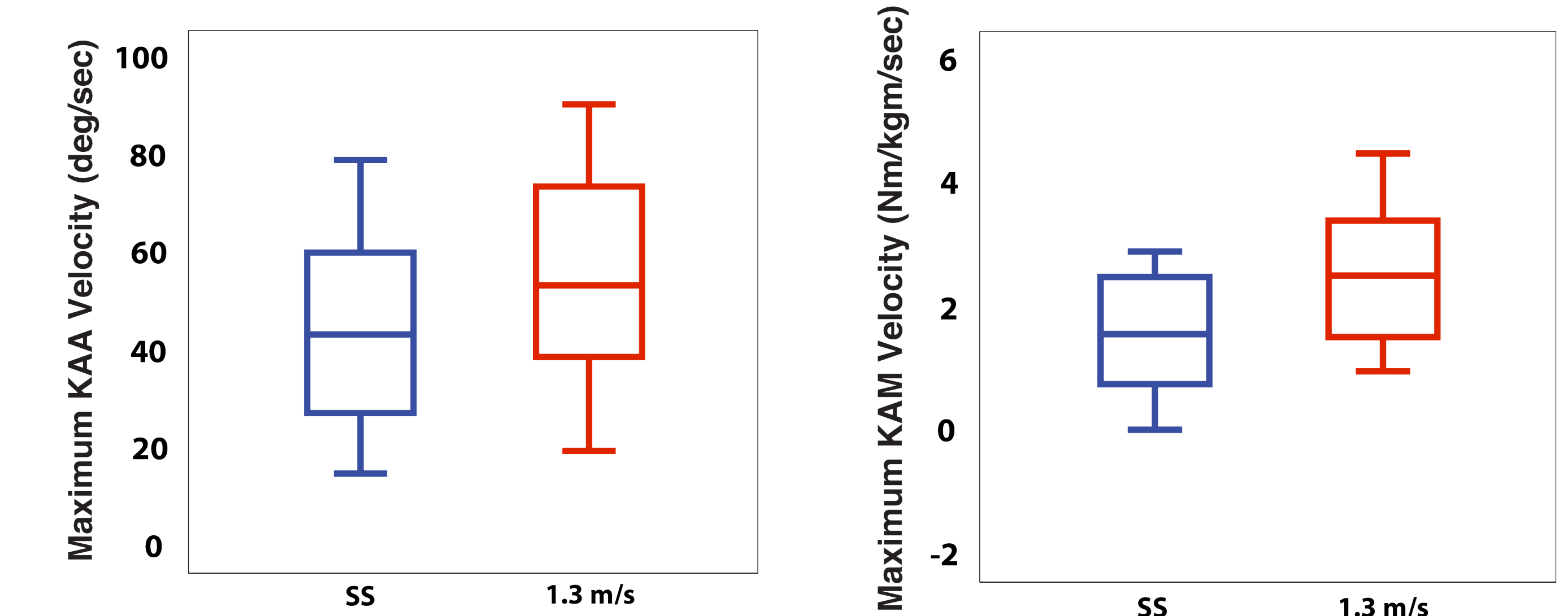
## RESULTS

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



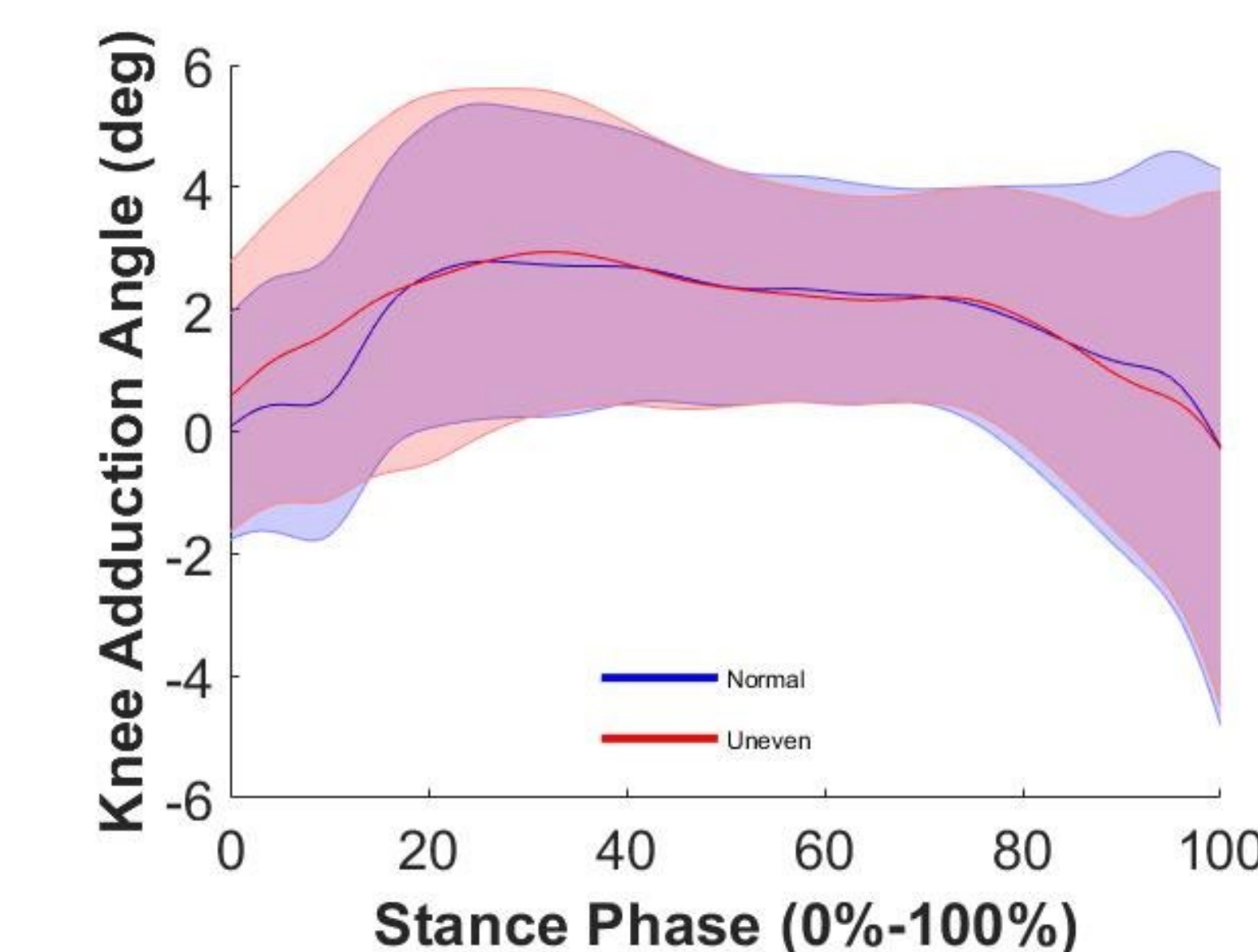
## RESULTS

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



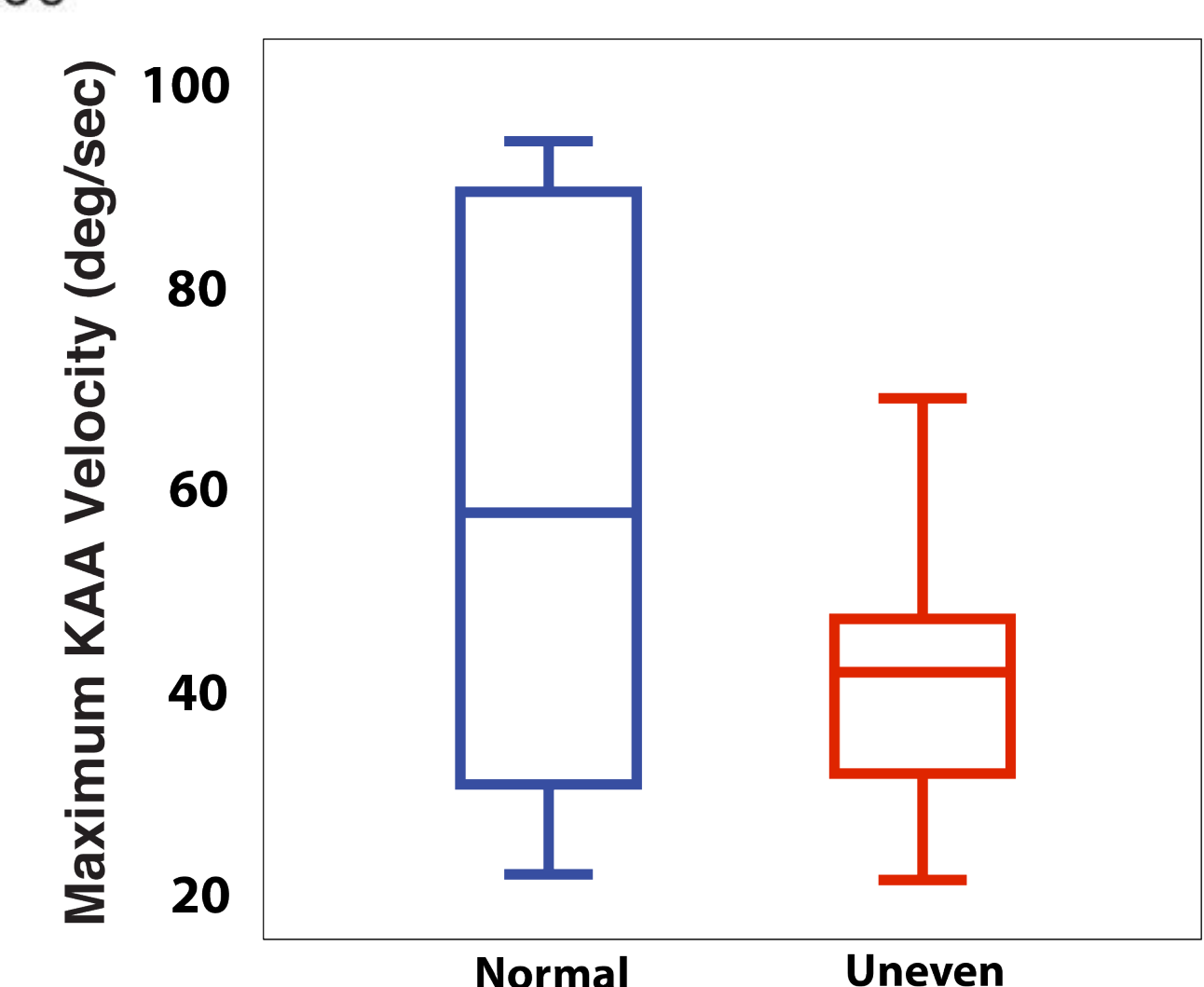
Max KAA and KAM increased 25% and 99% during 1.3 m/s walk.

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.



## CONCLUSION

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

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

**IMPACT:** Provide insight on walking over different surfaces that could help further information on Knee Varus and Valgus in OA and ACL-R Populations.

## ACKNOWLEDGEMENTS

NIH NIGMS (2U54GM104944) supported this work