

# Can we use treadmills for real-time optimization of ankle foot orthoses?

Laura Oudenhoven, Carlijn Hendriks, Annemieke Buizer, Marjolein van der Krogt

Amsterdam UMC, Vrije Universiteit Amsterdam, Department of Rehabilitation Medicine, Amsterdam Movement Sciences

## Introduction

- **Ankle foot orthoses** (AFOs) are frequently prescribed to improve gait in children with cerebral palsy
- Effects are dependent on **alignment** with respect to ground reaction force<sup>1</sup>
- Alignment can be manipulated by tuning of heel height
- **Instrumented treadmills** offer benefits for evaluation of tuning-effects:
  - Inclusion ↑↑ strides
  - Real-time evaluation of tuning protocols

*"It is unknown whether an optimally tuned AFO on a treadmill, is also optimally tuned for overground walking"*

## Purpose

**To investigate whether the effect of AFO-tuning is comparable between overground and treadmill walking**

## Methods

### Participants:

- Fourteen healthy adults: 3D-gait analysis, wearing a custom fabricated carbon AFO

### Two gait laboratories:

- Overground: 10m-walkway
- Instrumented treadmill (GRAIL)

Data analysed with Human Body Model<sup>2</sup>

### Five conditions: AFO-tuning protocol

- Heel height incremented by applying wedges

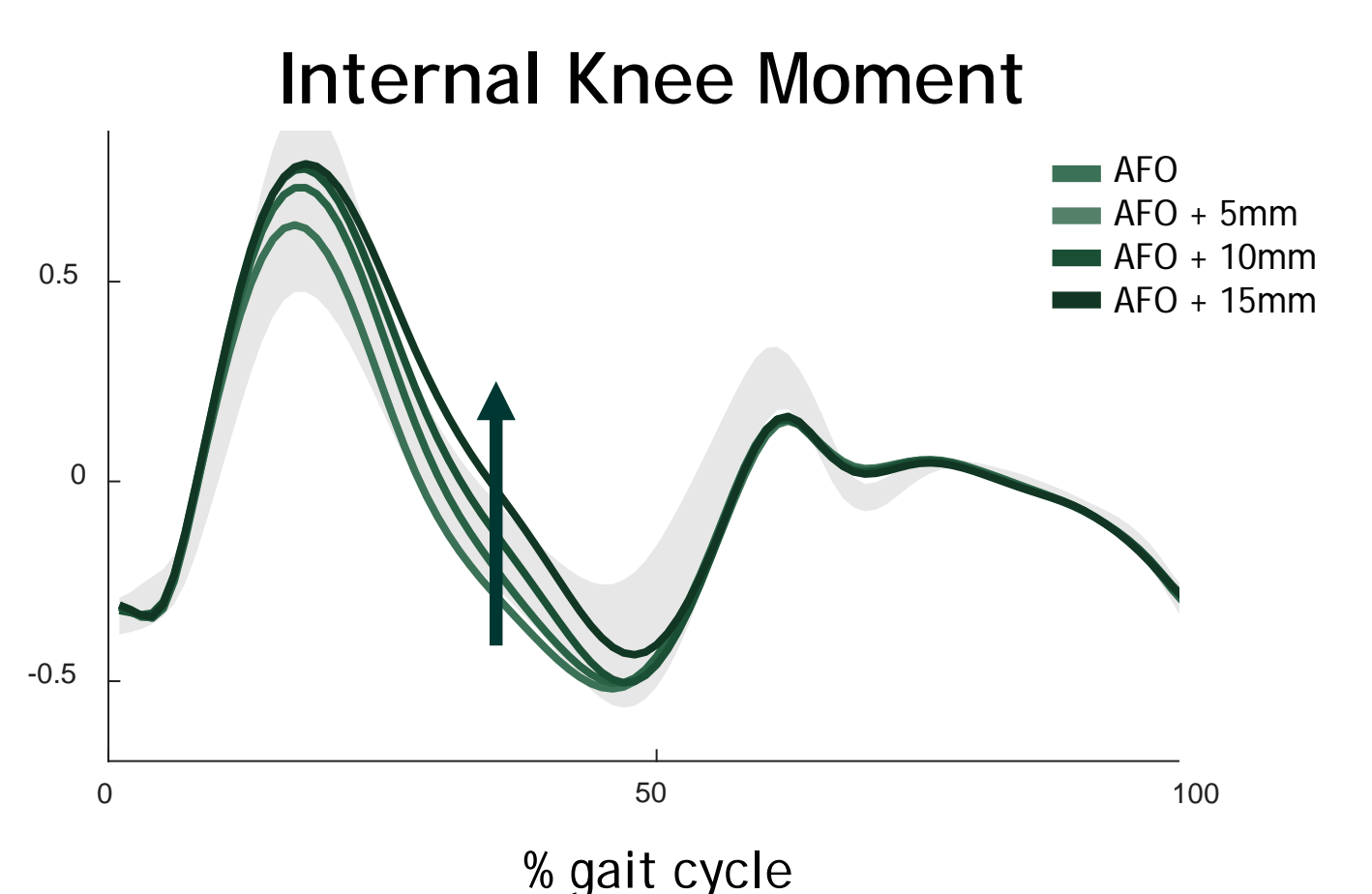
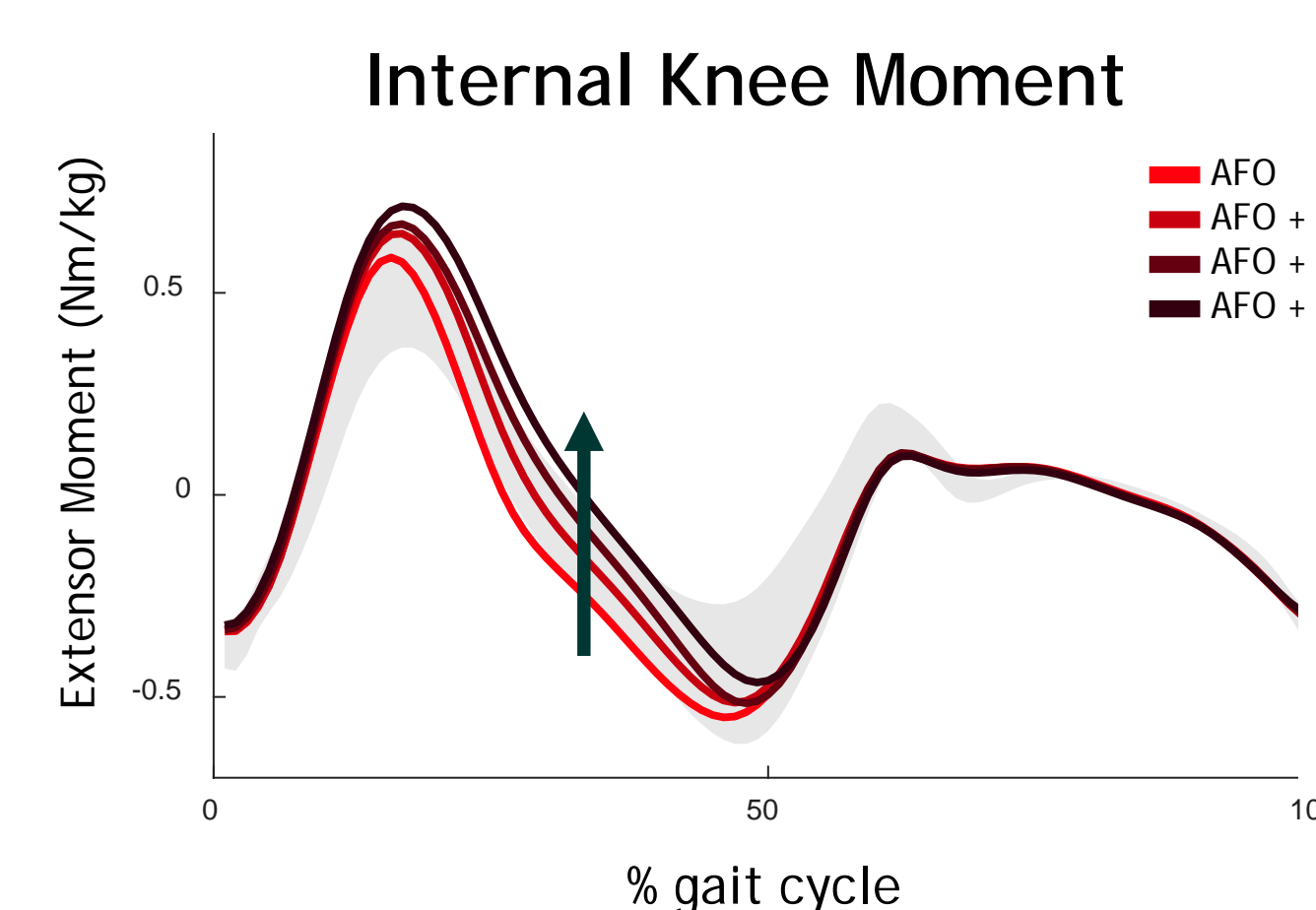
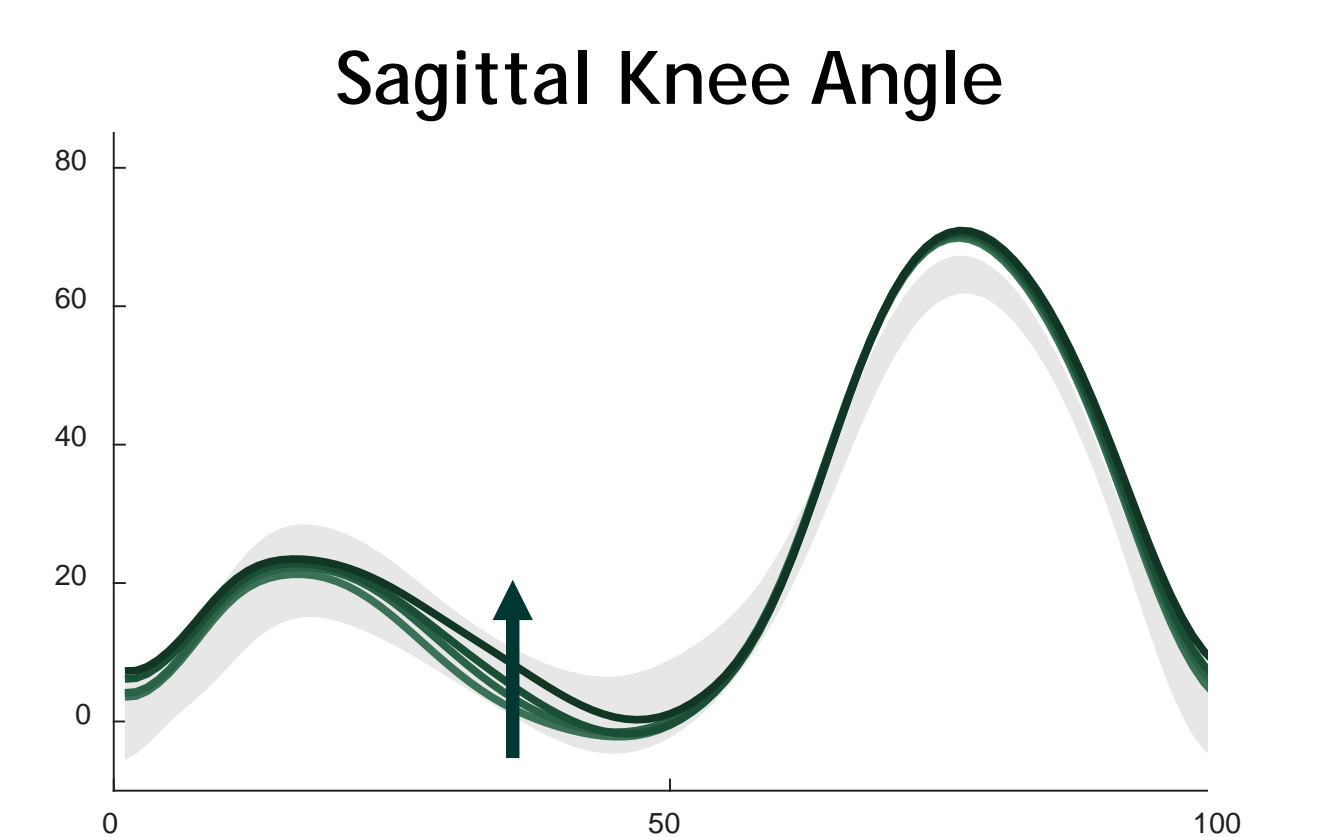
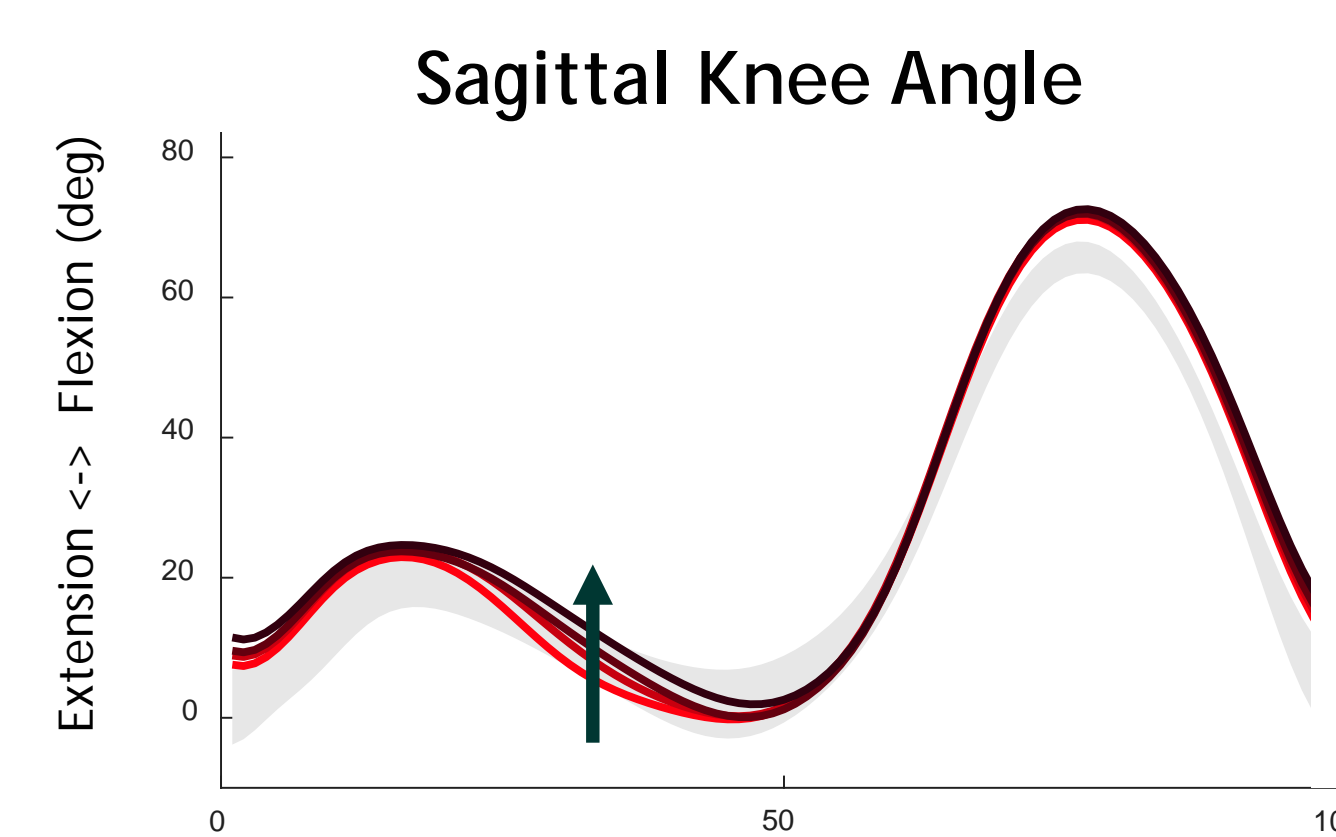


## Results

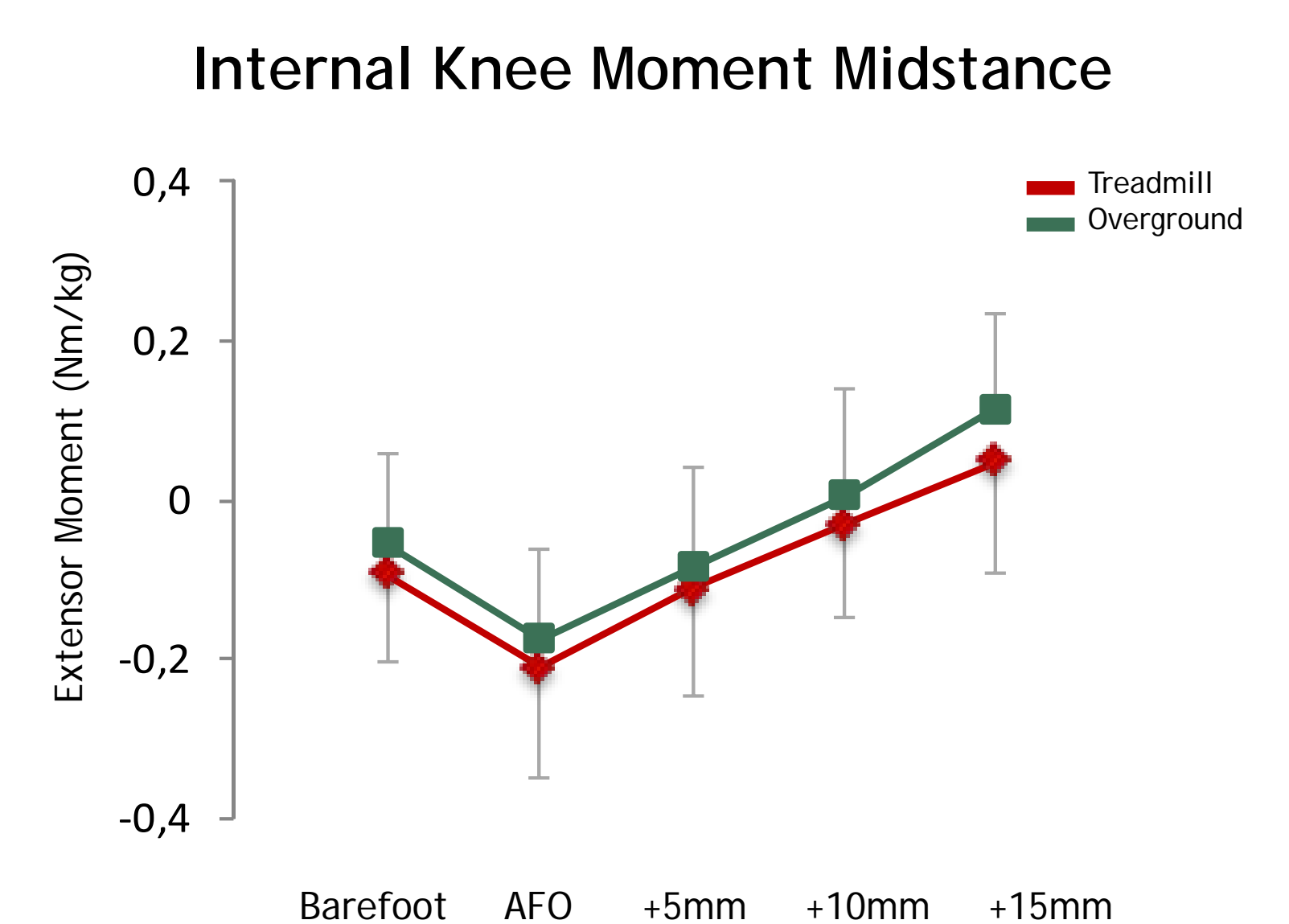
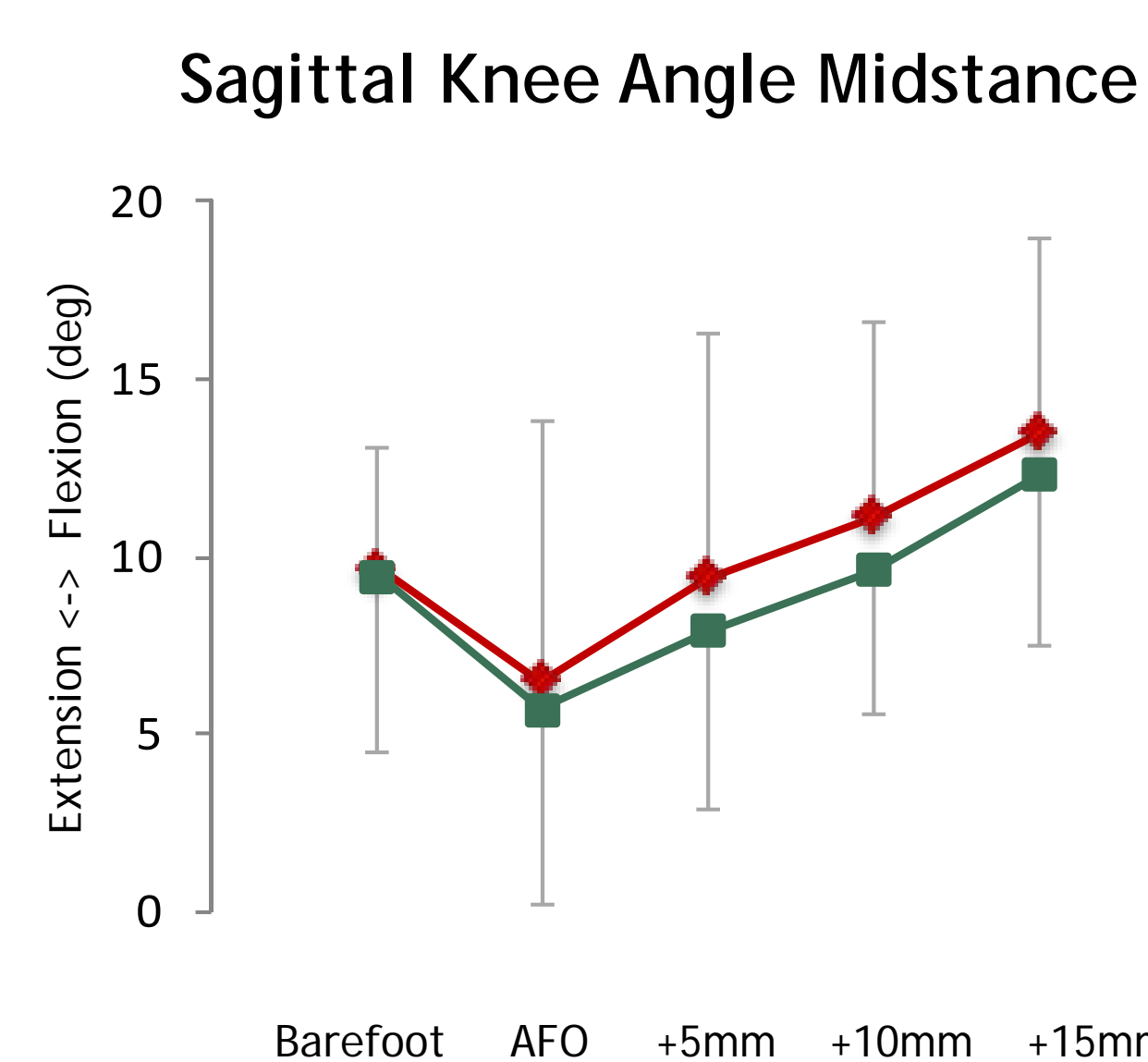
### Treadmill



### Overground



- **Effect incremented heel height** (at midstance)
  - ↑ Knee flexion ( $p < .01$ )
  - ↑ Shank to vertical angle ( $p < .01$ )
  - ↑ Internal knee extension moment ( $p < .01$ )
- **Treadmill versus overground**
  - No significant differences ( $p > .05$ )
  - Effect of incremented heel height comparable ( $p > .05$ )



## Conclusions

- **Treadmills can be used for evaluation and optimization of AFOs**
- **Important to use appropriate reference data (Treadmill / Overground)**

