THE EFFECTS OF SPEED ON FOOT ROCKERS
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INTRODUCTION
Locomotion is a foundational component for daily living. Legged locomotion can be broken down into two
gait patterns, walking and running [1]. The hip, knee, and ankle joints have different roles depending on
the phase of walking & running and must work together to produce and absorb forces to allow efficient
movement through the stance phase. In walking, this is accomplished by three rockers: the heel rocker, the
ankle rocker, and the forefoot rocker. While foot position at initial contact in running has been extensively
studied, little research has framed foot and ankle motion in running in context of the foot rockers even
though at slow running speeds, 80 to 90% of shod runners’ heel strike and exhibit all three rockers [2].

Thus, the purpose of this study is to 1) to determine the effect of gait speed on the presence and timing of
foot rockers, and 2) to determine the relationship between the foot rockers and lower extremity kinematics
and the vertical displacement of the center of mass (COM) at different gait speeds ranging from a slow
walk to a fast run in order to determine baseline measurements for future research.

METHODS
We plan to collect data on thirty-five healthy college aged students, who will give their written informed
consent and volunteer to participate. Following a warm-up, subjects will complete one minute walking and
running trials at eight speeds ranging from 1.2 m/s to 3.6 m/s on a treadmill. One minute of rest at 1.3 m/s
will be provided between trials.

Nineteen reflective markers placed on key anatomical landmarks will be used to create an eight-segment
model using a modified Plug-in-Gait marker set (Vicon, Centennial, CO). Motion capture data (Vicon
Nexus) will be collected at 120 Hz for the last 20 seconds of each trial.

Ten strides of data for each speed will be analyzed. Visual 3D will be used to calculate the start and stop
off the heel, ankle, and forefoot rockers based on guidelines of Bober, et al. [3], lower extremity joint
kinematics, and COM vertical displacement for each stride. Descriptive statistics will be calculated in SPSS
for the foot rocker variables. One-way repeated measures ANOVA will be used to determine significant
differences in the timing of the foot rockers across the treadmill speeds. Alpha = 0.05.

RESULTS
To date, data on twenty-six subjects (age (y): 20.4, height (cm): 161.2, mass (kg): 70.1) has been collected,
and analysis has been completed on five subjects. It is anticipated that, by the end of April, all subjects’
data will be analyzed and a manuscript will be submitted for publication.

DISCUSSION AND CONCLUSION
Due to the scarcity of current research, this study’s analysis of the foot rockers could become baseline
measurements for researchers, clinicians, and rehabilitation specialists. This information can be used to
help identify injury mechanisms by examining the foot rockers of people with injuries and comparing them
to normative values established in this study.

These baseline measurements can also be used in prosthesis design for individuals who have had lower
limb amputations. Prosthetists may be able to build limbs that can mirror normal foot and ankle rockers of
gait over different speeds. A prosthetic foot that is able to change its mechanics as speed changes greatly
improve function for lower limb amputees. Normative data on foot rockers may also be used to create footwear or design interventions for people who have atypical foot and ankle mechanics.

REFERENCES
