

## **Barefoot to Shod: Understanding Children's Gait Kinematics in Different Footwear Conditions**

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### **ABSTRACT**

As children undergo crucial developmental phases, their walking patterns play a pivotal role in musculoskeletal health. It is crucial to explore how different walking conditions may impact the natural gait patterns of children, contributing to advancements in pediatric biomechanics and the promotion of healthy foot development. **PURPOSE:** The purpose of this study was to investigate the biomechanical differences of walking barefoot versus wearing shoes. We aim to provide valuable insights for the design of footwear tailored to different developmental stages. Fostering optimal gait patterns and contributing to the overall well-being of the pediatric population. **METHODS:** Eleven healthy children, between the ages of 4-6 participated in this study (Age =  $4.8 \pm .8$  years, ht =  $44.1 \pm 3.8$  in, wt =  $47.1 \pm 13.4$  lbs). The children walked barefoot, and while wearing a lab provided shoe (Nike Free), on an instrumented treadmill for 3-minutes while motion capture data was captured. Gait kinematics, including range of motion (ROM) and peak joint angle velocities of the ankle, knee, and hip were computed using Visual3D and custom Matlab software from the motion capture marker trajectories. Dependent t-tests were used to compare the barefoot and the footwear conditions for each of the variables with an alpha of ( $p = .05$ ). **RESULTS:** There were significant differences for five of the nine dependent variables. Specifically, knee flexion/extensionROM, knee flexion peak velocity, hip flexion peak velocity, and hip extension peak velocity all increased in the footwear condition compared to the barefoot condition ( $p < .05$ ). Interestingly knee extension peak velocity significantly decreased in the footwear condition compared to the barefoot condition ( $p < .05$ ). The other dependent variables were not significantly different ( $p > .05$ ). **CONCLUSION:** This study illuminates notable distinctions in children's gait kinematics between barefoot and shod conditions. While barefoot walking allows for a more natural and flexible gait, the introduction of shoes influences children's gait biomechanics, potentially affecting their musculoskeletal development. Future investigation into the long-term effects of habitual footwear use in children should be pursued.