# THE EFFECTS OF WEARING ROLLER SHOES ON GROUND REACTION FORCE CHARACTERISTICS DURING WALKING

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**KEY WORDS:** roller shoes, ground reaction force, walking

**INTRODUCTION:** Roller shoes have become increasingly popular among children and it features retractable wheels which allowing the user to walk or roll without changing the footwear. Maintaining balance during forward walking with roller shoes is not an easy task. To prevent falling backward, the user needs to lock the knees and tighten the ankles and thighs while the upper body is slightly leaning forward. Constant walking with roller shoes forces the user to walk in a manner much different from normal gait. Prolonged exposure to un-natural stresses on human body forces our body to evolve by strengthening those incorrect, and temporary functions (Clement et al., 1981). For children, the chronic stress may lead to serious injuries in the lower extremity later in life. If any potential of injury exists in a movement it is critical to examine the associated forces that may lead to injury. To the best of our knowledge, the effects of wearing roller shoes on ground reaction forces (GRF) characteristics have rarely been studied, especially in the youth population. Thus, the purpose of this study was to compare GRF characteristics during walking wearing jogging and roller shoes.

**METHODS:** Twelve male middle school students (age: 15.0 ± 00 yrs, height: 173.6 ± 5.0 cm, weight: 587.6 ± 89.3 N) who have no known musculoskeletal disorders were recruited as the subjects. Kinematic data from six S-VHS camcorders (Panasonic AG456, 60 fields/s) and GRF data from two force platforms (AMTI OR6-5) were collected while subjects walked wearing roller and jogging shoes in random order at a speed of 1.1 m/s. An event sync unit with a bright LED light was used to synchronize the video and GRF recordings. GRF data were filtered using a 20 Hz low pass Butterworth digital filter and further normalized to the subject's body weight. For each trial being analyzed, five critical instants and four phases were identified from the recording. Temporal parameters, GRFs, displacement of center of pressure (DCP), and loading and decay rates were determined for each trial. For each dependent variable, paired t-test was performed to test if significant difference existed between shoe conditions ($p \leq .05$).

**RESULTS AND DISCUSSION:** Vertical GRFs at heel contact increased and braking forces at the end of initial double limb stance reduced significantly when going from jogging shoe to roller shoe condition. Robbins and Waked (1997) reported that balance and vertical GRF are closely related. It seems that the ankle and knee joints are locked in an awkward fashion at the heel contact to compensate for the imbalance. The DCP in the antero-posterior direction for the roller shoe condition was significantly less than the corresponding value for the jogging shoe condition. Because the subjects tried to keep their upper body weight in front of the hip to prevent falling backward, the DCP for the roller shoe condition was restricted. The results indicate that walking with roller shoes had little effect on temporal parameters, and loading and decay rates.

**CONCLUSION:** It seems that there are differences in GRF characteristics between roller shoe and jogging shoe conditions. The differences in GRF pattern may be caused primarily by the altered position of ankle, knee, and center of mass throughout the walking cycle. Future studies should examine muscle activation patterns and joint kinematics during walking with roller shoes.

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