THE EFFECTS OF WEARING ROLLER SHOES ON MUSCLE ACTIVITY IN THE LOWER EXTREMITY DURING WALKING

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KEY WORDS: roller shoes, EMG, walking

INTRODUCTION: Roller shoes have become increasingly popular among children and its features of retractable wheels which allow 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 muscle activity that may lead to injury. To the best of our knowledge, the effects of wearing roller shoes on muscle activity in the lower extremity have rarely been studied, especially in the youth population. Thus, the purpose of this study was to compare muscle activity in the lower extremity during walking wearing jogging and roller shoes.

METHOD: 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. Seven pairs of surface electrodes (QEMG8, Laxtha Korea, gain = 1,000, input impedance >1012 Ω, CMMR >100 dB) were attached to the right-hand side of the body to monitor the rectus femoris (RF), vastus medialis (VM), vastus lateralis (VL), biceps femoris (BF), tibialis anterior (TA), and medial (GM) and lateral gastrocnemius (GL) 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 EMG recordings. EMG data were filtered using a 10 Hz to 350 Hz Butterworth band-pass digital filter and further normalized to the respective maximum voluntary isometric contraction EMG levels. For each trial being analyzed, five critical instants and four phases were identified from the recording. Averaged IEMG and peak IEMG were determined for each trial. For each dependent variable, paired t-test was performed to test if significant difference existed between shoe conditions ($p \le .05$).

RESULTS AND DISCUSSION: The VM, TA, BF, and GM activities during the initial double limb stance and the initial single limb stance reduced significantly when going from jogging shoe to roller shoe condition. The decrease in EMG levels in those muscles indicated that the subjects locked the ankle and knee joints in an awkward fashion to compensate for the imbalance. Muscle activity in the GM for the roller shoe condition was significantly greater than the corresponding value for the jogging shoe condition during the terminal double limb stance and the terminal single limb stance. Because the subjects tried to keep their upper body weight in front of the hip to prevent falling backward, the GM activity for the roller shoe condition increased.

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

REFERENCES:

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