MATURATION EFFECTS ON LOWER EXTREMITY KINEMATICS IN A DROP VERTICAL JUMP

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KEY WORDS: maturation, lower extremity, kinematics.

INTRODUCTION: As children increase in biologic age, body height and weight increase, and subsequent maturation of the nervous, endocrine, muscular, and cardiovascular systems leads to alterations in neuromuscular performance (Naughton et al., 2000). It is important to understand the effects of growth and development on sports performance and sports injuries. The purpose of this study were to investigate maturation effects on lower extremity kinematics in a drop vertical jump.

METHOD: Three-dimensional video graphic data were collected for 11 prepubescent females (7~10 age), 11 pubescent females (13~16 age), and post pubescent females (21~24 age) performing a drop vertical jump. A total of 21 reflective markers were then placed in pre-assigned positions. The subject was instructed to drop off the box, leave both feet at the same time, land, and then immediately perform a maximum vertical jump. Three trials were performed from a wooden box of each subject's relative knee lateral epicondyle height. In this controlled laboratory study, a one-way ANOVA experimental design was used for the statistical analysis ($p<.05$). Post-hoc tests with Tukey's correction were used.

RESULTS: Pubescent and post pubescent females demonstrated significantly decreased knee flexion angles (21.3 ± 6.7, 22.9 ± 5.6, 28.4 ± 7.1, respectively) ($p<.05$) and hip flexion angles (27.5 ± 8.4, 28.7 ± 7.7, 41.3 ± 9.5, respectively) ($p<.05$) at initial ground contact during the landing of a drop vertical jump task than prepubescent females.

DISCUSSION: The results of this study supported previous study that Hass et al. (2003) showed a significant decrease in knee flexion angles during the landings of post pubescent subjects in stride jump landing task in comparison to prepubescent subjects. Landing with small knee flexion angles in a drop vertical jump task may increase the load on the ACL. Previous study on knee anatomy and biomechanics have shown that the anterior shear force applied on the tibia by the quadriceps muscles increases as the knee flexion angle decreases because the patellar tendon-tibial shaft angle increases as the knee flexion angle decreases (Buff et al., 1988). The results of this study provide significant information for research on the prevention of non-contact anterior cruciate ligament injuries.

CONCLUSION: Pubescent and post pubescent females have decreased knee and hip flexion angles at initial ground contact and decreased knee and hip flexion motions during the landing of a drop vertical jump task than prepubescent females. These age differences in knee and hip flexion motion patterns occur after the onset of puberty.

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