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Dynamic knee valgus alignment influences impact attenuation in the lower extremity during the deceleration phase of a single-leg landing

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Abstract

Dynamic knee valgus during landings is associated with an increased risk of non-contact anterior cruciate ligament (ACL) injury. In addition, the impact on the body during landings must be attenuated in the lower extremity joints. The purpose of this study was to investigate landing biomechanics during landing with dynamic knee valgus by measuring the vertical ground reaction force (vGRF) and angular impulses in the lower extremity during a single-leg landing. The study included 34 female college students, who performed the single-leg drop vertical jump. Lower extremity kinetic and kinematic data were obtained from a 3D motion analysis system. Participants were divided into valgus (N = 19) and varus (N = 15) groups according to the knee angular displacement during landings. The vGRF and angular impulses of the hip, knee, and ankle were calculated by integrating the vGRF-time curve and each joint's moment-time curve. vGRF impulses did not differ between two groups. Hip angular impulse in the valgus group was significantly smaller than that in the varus group (0.019 ± 0.033 vs. 0.067 ± 0.029 Nms/kgm, $p<0.01$), whereas knee angular impulse was significantly greater (0.093 ± 0.032 vs. 0.045 ± 0.040 Nms/kgm, $p<0.01$). There was no difference in ankle angular impulse between the groups. Our results indicate that dynamic knee valgus increases the impact the knee joint needs to attenuate during landing; conversely, the knee varus participants were able to absorb more of the landing impact with the hip joint.

Introduction

The anterior cruciate ligament (ACL) is frequently injured during soccer, basketball, and many other sports. In recent studies, the mechanism of ACL injury has been widely considered