Vertical Ground Reaction Force Differs by Maturation Stage in Pediatric Patients Following an ACL Reconstruction

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BACKGROUND: Rates of anterior cruciate ligament reconstructions (ACLR) are steadily increasing in the pediatric population. Adult ACLR individuals exhibit altered gait biomechanical profiles, specifically demonstrating less-dynamic vertical ground reaction force (vGRF) profiles (i.e., lesser first and second peak vGRF and greater midstance vGRF) compared to uninjured controls. However, vGRF profiles in the pediatric ACLR population have not been determined and it is unclear if vGRF profiles in pediatric ACLR patients differ by maturation stage. PURPOSE: To determine walking vGRF profiles of ACLR patients as stratified by maturation stage (i.e.,Tanner Stages [TS] 3-5). METHODS: Participants performed a gait assessment and completed the Tanner Stage questionnaire at a single time point. vGRF was time normalized to 100% stance phase and to body weight. A functional mixed effect model was used to compare the vGRF between groups at each 1% stance phase. RESULTS: The TS3 group demonstrated lesser vGRF surrounding the first vGRF peak compared to the TS4 (5%) and TS5 group (4%) and lesser vGRF surrounding the second peak (0.5%) compared to the TS5 group. The TS4 group demonstrated lesser vGRF compared to the TS5 group (0.6%). CONCLUSION: Apparent vGRF profile differences were observed in pediatric ACLR patients between TS3 and TS5, with TS3 demonstrating lesser vGRF loading surrounding the bimodal vGRF peaks. Minimal vGRF profile differences were observed between pediatric ACLR patients in later maturation stages. Future work should identify if vGRF profiles in pediatric ACLR patients differ from uninjured pediatric controls of the same maturation stage.