Humeral Torque in Youth Baseball Pitchers : Implications for the Deveopment of Little League Shoulder and Humeral Retroversion

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Recent research suggests retrotorsion of the humerus in the dominant arms of throwers may affect range of motion. While it has been suggested that increased retrotorsion is most likely to occur at the epiphyses of skeletally immature athletes, it is not clear what drives the changes to occur. The large shoulder and elbow forces generated during the pitching motion have been well documented. However, the relationship between pitching biomechanics and development of retrotorsion of the humerus has not been studied. The aim of this study was to provide a potential mechanism for development of humeral retrotorsion and little league shoulder. Two high-speed video cameras were used to videotape 14 little leagus pitchers throwing fastballs from and dominant side views. The locations of 21 body landmarks were digitized manually and the three-dimensional locations of each of the points were calculated. The joint kinematics and kinetics and the net force and torque acting on the humerus were calculated in fourteen youth pitchers throwing in a simulated game. The major force component acting on the humerus was a tensile force of 378±81 N that peaked just after ball release. The predominant torque on the humerus was an external rotation torque about the long axis of the humerus. This torque reached a peak value of 35.3±6.7 Nm about 73% through the pitching motion. This torque is approximately 66% of the torque required to fracture the adult humerus. The direction of the humeral torque was consistent with the development of increased humeral retrotorsion in the throwing arm. Shear stress arising from the high torque during the late cocking phase likely leads to

deformation the relatively weak proximal humeral epiphysis. The external rotation torque applied to the humerus during the pitch also agrees with the proposed mechanism for development little league shoulder, which has been hypothesized to be due to rotational stresses acting on the epiphysis during the throwing motion.