Magnetic Resonance (MR) images (McLean 2010). Specifically lateral tibial slope (LTS) angle, and normalized (body weight) anterior cruciate ligament (ACL) and intercondylar notch (ICN) volume. Subjects were stratified into early, mid and later pubertal groups via two previously validated methods; the Pubertal Maturation Observation Scale (POMOS) (Quatman et al., 2006) and the Skeletal Maturation Scale (SMS) (O’Connor et al., 2012). The main effect of maturation on each measure was examined via two-tailed t-tests and compared between scales. An alpha level of p=0.05 denoted statistical significance.

RESULTS: Using the SMS, 3 (avg=10 yrs), 5(avg=14 yrs), 5(avg=14 yrs) subjects were stratified into respective early, mid, and late maturation groups, with significant differences in ACL volumes and LTS angle between early/mid and all measures between early/late subjects. Using the POMOS 8 (avg=11.4 yrs), 0, and 8 (avg=15 yrs) subjects were stratified into respective early, mid, and late maturation groups with a significant difference in ACL volume between early/late groups.

CONCLUSIONS: Current results demonstrate the observed sensitivity of key knee morphologies to maturation status is directly dependent on the overarching maturation stratification method. With such morphologies considered key risk factors for knee injury, an inaccurate delineation of maturation state may adversely impact future risk screening and prevention methods. In particular, determination of optimal timing for implementing these methods may be compromised. Maturation stratification via tibial and femoral epiphysial plate data, as with the SMS approach, appears to provide the most objective means of defining maturation state as this research theme continues to move forward.

Children are characterized by lower muscle strength compared with adults, even after correcting for size differences. Their maximal rate of force development has also been demonstrated to be lower than adults.

PURPOSE: To investigate maturational changes in the rate of force development and the factors that may affect these changes.

METHODS: Participants were 21 pre-pubertal (PPh; 9.9±1.3yrs), 17 late-pubertal (LP; 13.6±1.5yrs), and 14 adult (Am; 21.8±1.7yrs) males; as well as 35 pre-pubertal (PPh; 9.8±1.1yrs), 13 late-pubertal (LP; 13.5±1.8yrs), and 15 adult (Am; 21.6±1.2yrs) females. Isometric peak torque (PT) and rate of torque development (RTD) were determined isometrically as well as isokinetically at 60 and 240°/s (Biodex System 3). Quadriceps muscle cross-sectional area (CSA) was estimated ultrasonically (GE Vingmed, B-Mode, 5Hz). Electromyography (EMG) was used to determine electro-mechanical delay (EMD) and the initial rate of EMG rise (Q30).

RESULTS: PT and RTD were significantly higher in males and increased significantly with maturity at all velocities, even after correction for muscle CSA. However, there were no significant differences in RTD between LP and adults of both sexes. The male isometric RTD was 60.1±19.9, 89.6±32.7, and 87.4±29.5 Nm.s-1.cm-2 in PPh, LPm and Am, respectively. A similar pattern was observed for females, as well as in the isokinetic contractions. EMD was similar in males and females and decreased with maturity. The male isometric EMD was 72.6±18.9, 66.8±14.5, and 62.4±21.7ms in LPm, LPf and Am and respectively. In comparison, similar patterns were observed for females. EMD was negatively correlated with RTD (r=0.26 to -0.31). On the other hand, no group differences were observed in the initial rate of EMG rise and it was not correlated with RTD.

CONCLUSIONS: Since EMD partly reflects musculo-tendinous stiffness, the results suggest that maturity-related differences in RTD are partly explained by age-related changes in musculo-tendinous stiffness, but not by changes in the rate of EMG rise. Further research is needed to examine maturity-related changes in neuromuscular factors which may affect muscle function.

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