INFLUENCE OF HIP STRENGTH AND RANGE OF MOTION ON LANDING KINEMATICS ACROSS MATURATION GROUPS IN YOUTH ATHLETES

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INTRODUCTION

- ACL injuries are increasing in the youth population and appears to coincide with physical maturation.¹
- Changes in landing patterns through maturation are suggested to contribute to increased risk of knee injuries in youth athletes.
- Factors contributing to altered landing kinematics throughout maturation are unknown.
- Hip range of motion (ROM) and strength are known to influence landing kinematics.
- It is unknown if these factors contribute to maturational changes in landing kinematics.

PURPOSE

To determine if hip strength and ROM are associated with lower extremity kinematics during a jump landing (JL) task, across-stages of maturation.

METHODS

ASSESSMENT OF HIP STRENGTH

- Isometric strength of the hip extensors (EXT), external rotators (ER), and abductors (ABD), were evaluated by testers with known reliability (ICC>0.80), using a hand-held dynamometer and stabilization straps. (Figures 5-7)

ASSESSMENT OF HIP ROM

- Hip internal rotation (IR) and external rotation (ER) ROM were measured with a digital inclinometer by testers who established an acceptable level of reliability (ICC>0.85), a priori. (Figures 2-4)

PARTICIPANTS

- One hundred and four (41 male, 63 female) youth athletes (13.4±3.1 yrs, 159.0±16.2 cm, 52.1±17.0 kg) volunteered to participate.

ASSESSMENT OF PUBERTAL MATURATION

- The validated modified Pubertal Maturation Observational Scale (PMOS) was used to determine stage of maturation.²
- Participants were dichotomized into 3 maturational categories: pre-pubertal, pubertal, post-pubertal. (Figure 1)

RESULTS

- No significant predictors

- Hip ROM
  - ER ROM: r=0.27, P<0.05
  - IR ROM: r=0.32, P<0.05
  - ABD+EXT ROM: r=0.31, P<0.05
  - KIR: r=0.30, P<0.05

- Hip strength
  - ER: r=0.32, P<0.05
  - IR: r=0.13, P<0.05

- Double-Leg Jump Landing Task
  - A three dimensional motion analysis system (Flock of Birds, Ascension Technologies; Burlington, VT) interfaced with Motion Monitor software (Innovative Sports Training; Chicago, IL), was used to assess hip and knee kinematics on the dominant limb during three JL trials.
  - The JL task required participants to jump from a 30-cm high box set 50% of their height away from a force plate platform and rebound for maximum vertical height upon landing. (Figure 8)

DATA REDUCTION AND ANALYSIS

- Peak isometric hip strength was normalized to body weight (%BW), while ROM was recorded to the nearest degree.
- Frontal and transverse plane hip and knee joint angles at initial contact (IC) (GRF>10N), peak joint angles (IC to peak knee flexion), and joint excursions (peak minus IC) during the deceleration phase of the JL tasks were used for analysis.
- Separate step-wise, multiple linear regressions determine the extent to which hip strength and ROM predicted hip and knee kinematics during the JL task.

SUMMARY AND CONCLUSIONS

- In pre-pubertal athletes, hip strength had more of an influence on landing kinematics, while hip ROM had more of an influence in the post-pubertal athlete.
- These findings suggest that intervention/prevention programs should focus on hip strengthening prior to puberty and incorporate ROM exercises as youth athletes mature.
- Future studies should examine the longitudinal relationship between hip function and landing biomechanics, and the effectiveness of interventions that are specific to pubertal stage.

REFERENCES