INTRODUCTION

Emphasis in the literature has begun to focus on the torso, and its role in dynamic human movement. When considering the anatomy of the lumbopelvic-hip complex, the torso is included. Lumbopelvic and torso efficient movement allows for optimal transfer of forces from the lower extremity to the upper extremity. In dynamic movement, it is imperative that one has proximal stability for distal mobility. It is the pelvis and torso that allow for the stable foundation for distal movement, specifically the gluteal muscle group which supplies the foundation for the pelvis and torso positioning.

It is known that as a part of the kinetic chain, the activations of the gluteal muscle group will affect the more distal segments of the lumbopelvic-hip complex [1]. However, the true dynamic manner of gluteal muscle activation and torso rotation has yet to be thoroughly researched. Furthermore, it is not known to what degree the gluteal muscle group is activated in the overhead throwing motion of a catcher throwing down to second base.

Overuse injuries as a consequence of physiological fatigue from repetitive stress and tissue adaptations that ultimately results in mechanical adaptations. With the rise in youth and adolescent throwing injuries, examination of the immature skeleton and its process of maturation are of concern. By understanding the muscle activation of the gluteal muscle group as well as torso kinematics in skeletally immature and mature catchers, pathomechanics may be identified in attempt to prevent injury. Therefore, the purpose of this study was to quantitatively analyze torso kinematics and gluteal muscle activations as well as the relationship between torso kinematics and gluteal activation from the position of shoulder maximum external rotation (MER) to ball release (BR) in skeletally immature and mature catchers as they throw down to second base.

METHODS

Forty-six competitively active baseball and softball catchers volunteered to participate. There were no differences between baseball and softball catchers on years of experience or age. Participants were divided into two categories of skeletally immature and mature. From the 46 participants we selected the youngest 10 participants (10.9 yrs; 144.3±10.3 cm; 38.7±10.8 kg) and described them as skeletally immature and oldest 10 participants (18.4 yrs; 169.9±8 cm; 74.9±11.8 kg) and described them as skeletally mature. All testing protocols were approved by the University’s Institutional Review Board.

Location of bilateral gluteus maximus and medius were identified through palpation. Adhesive 3M Red-Dot bipolar (Al/AgCl) disk (6cm) surface electrodes were attached over the muscle bellies and positioned parallel to muscle fibers. Manual muscle tests were then conducted to establish baseline reading for each participant’s maximum voluntary isometric contraction (MVIC) to within all sEMG data could be compared.

All sEMG data were transmitted to The MotionMonitor™ (Innovative Sports Training, Chicago, IL) through a Noraxon Myopac 1400L (Noraxon, USA, Inc, Scottsdale, AZ) eight channel amplifier. Signals were full wave rectified and smoothed based on the smoothing algorithms of root mean squared at windows of 1000ms, sampling at a rate of 1000 Hz and notch filtered at frequencies of 59.5 Hz and 60.5 Hz respectively.

In addition to sEMG data, kinematic data were collected using a series of 10 electromagnetic

RELATIONSHIP BETWEEN TORSO ROTATION AND GLUTEAL MUSCLE GROUP ACTIVATION IN BASEBALL AND SOFTBALL CATCHERS: SKELETALLY IMMATURE AND MATURE

Gretchen Oliver, Hillary Plummer and Priscilla Dwelly

University of Arkansas, Fayetteville, AR, USA
email: goliver@uark.edu
sensors that were attached at the following locations: torso at C7; pelvis at S1; distal, posterior aspect of throwing and non-throwing humerus; distal, posterior aspect of throwing and non-throwing forearm; distal, posterior aspect of throwing and non-throwing side upper leg; and distal, posterior aspect of throwing and non-throwing side lower leg.

Participants then were given an unlimited time to warm-up. For collection, participants were pitched five fastballs from a pitcher located regulation distance. The participant was to catch the pitched ball and then throw down to second base in attempt to throw out a stealing base runner.

Data were analyzed at the events of foot contact (FC), MER, BR, and maximum shoulder internal rotation (MIR).

RESULTS AND DISCUSSION
Means of sEMG (Figures 1-2) and torso kinematics are presented (Figure 3). Pearson product moment correlations revealed significant relationships between right gluteus maximus ($r=.66$, $p=.004$), medius ($r=-.57$, $p=.02$) and left gluteus maximus ($r=.67$, $p=.003$) and torso rotation in skeletally immature catchers. While no significant relationships existed between the torso rotation and gluteal activation in the skeletally mature catchers.

CONCLUSIONS
Data reveal although there were significant relationships between gluteal activation and torso rotation in immature catchers, it is speculated that they rotated their torso early in the throwing motion based on the quantitative kinematic torso data. In addition, the lack of relationship between torso rotation and gluteal activation, in the mature catchers identify the lack of posterior chain utilization in the throwing motion. Lack of torso control as evident of early rotation, as well as lack of total kinetic chain sequencing ultimately results in more emphasis placed on the upper extremity. With more performance emphasis placed on the upper extremity, injury propensity could possible increase. These data are the first to be reported for catchers, thus further research is needed to verify these data as well as identify injury implications.

REFERENCES