

## **Sports Motion Analysis: Assessing Lower Extremity Biomechanics and Knee Injury Risk**

- ❖ Christopher Powers, PhD, PT, Professor, Division of Biokinesiology & Physical Therapy, University of Southern California
- ❖ Mia Katzel, PT, DPT, Motion Lab Sports Physical Therapist, Children's Hospital Los Angeles (CHLA)
- ❖ Kyle Chadwick, MS, Motion Lab Engineer, CHLA
- ❖ Tishya Wren, PhD, Director of Research, Motion Analysis Lab, CHLA

**Purpose:** To introduce a method to identify movement impairments during sport specific tasks that may increase the risk for lower extremity injury, particularly knee and anterior cruciate ligament (ACL) injury. Methodologies will be presented for both 3D assessment in a traditional motion analysis laboratory and more “clinic friendly” 2D assessment.

**Intended Audience:** Physicians, physical therapists, kinesiologists, biomechanists, motion lab engineers, researchers, and students interested in sports biomechanics, sports injuries, return-to-sport decision-making, injury prevention, and rehabilitation after ACL injury and reconstruction

**Prerequisite Knowledge:** None required

**Learning Objective:** At the completion of this presentation, attendees will be able to: 1) describe movement impairments underlying various lower extremity conditions (particularly ACL and knee injury), 2) perform a sport-related movement assessment that can identify these movement impairments, and 3) describe methods to quantify “at risk” movement impairments using 2D and 3D motion analysis.

**Abstract:** This course will describe the assessment of lower extremity biomechanics during tasks relevant to sports, with a focus on identifying movement impairments related to ACL and knee injury. Fundamental principles of injury mechanics will be presented, along with a framework for assessing lower extremity biomechanics of athletes. Clinical protocols for performing such assessments using 2D and 3D motion analysis will be described, and relevant research findings will be discussed.

## Course Outline:

### 1. *Background on Knee Biomechanics and ACL injury (C. Powers)*

We will discuss what is currently known about lower extremity biomechanics and knee/ACL injury.

### 2. *Framework for Assessing Lower Extremity Biomechanics (C. Powers)*

We will present a framework and scoring rubric for assessing lower extremity biomechanics focusing on knee injury risk.

### 3. *Implementation of 2D Assessment as a Clinical Service (C. Powers)*

We will describe a clinical implementation of the biomechanics assessment using video-based motion capture that has been used on over 600 patients.

### 4. *Implementation of 3D Assessment as a Clinical Service*

#### a. Patient Testing/Treatment Protocols (M. Katzel)

We will provide an overview of our protocols for assessing movement biomechanics using kinematics and kinetics, assessing muscle activation using EMG, and providing treatment including EMG-based biofeedback.

#### b. Technical Considerations and Processing Workflow (K. Chadwick)

We will provide an overview of our technical workflow including data collection procedures, marker set and modeling considerations, data processing methods, and report generation.

### 5. Research (T. Wren, C. Powers)

We will summarize some of the relevant research that has been performed in our labs. Likely topics include biomechanical deficits after ACL reconstruction, asymmetry in patients and controls, and biomechanical predictors of repeat ACL injury.