

## Comparison of Goniometry and Video Analysis in Measuring Shoulder Range of Motion of Collegiate Athletes

Matt Waltz<sup>1</sup>, Ryan Heumann<sup>1</sup>, Marcel M. Garcia-Hosokawa<sup>2</sup>, Arthur L. Chlebowski<sup>1,3</sup>

<sup>1</sup>Indiana University School of Medicine; <sup>2</sup>Active Chiropractic and Rehabilitation Clinic;

<sup>3</sup>University of Southern Indiana, Department of Engineering

**Background:** The shoulder joint's multiplanar motion creates a challenge in measurement of range of motion (ROM). Goniometry is currently the most common tool for measuring ROM in the clinic due to its ease of use, but is subjective in nature. Video capture rigs have become popular in all facets of motion monitoring, but they can be limited to large open spaces and user discrepancy. Further, motion capture with wireless wearable inertial measurement units (IMUs) has also become popular but is often cost/implementation prohibitive. Understanding the consistency between these recording methods must be established to understand if a therapy impacts the shoulder complex.

**Methods:** Student athletes with complaints of shoulder pain and decreased ROM in their dominant arm were separated into cohorts receiving twelve therapy sessions. One cohort received chiropractic manipulation therapy and the other received functional movement-based myofascial release therapy combined with chiropractic manipulation. Shoulder ROM was measured via seven standard tests during the first, sixth, and last sessions using goniometry, video capture, and IMUs. Following data collection, results of the measurement techniques were compared.

**Results:** Preliminary statistical analysis conducted between goniometry and video capture indicates measurement techniques differ for three of seven standard ROM tests, pronated flexion, supinated abduction, and internal rotation ( $p$ -value  $\leq 0.05$ ). Reliability between individuals analyzing video capture is strong, with an ICC of 0.994. This indicates consistency between individuals taking measurement of shoulder ROM using this method. IMU data has been collected with analysis forthcoming.

**Conclusion:** This study is limited by the number of participants ( $n=4$ ). Preliminary results indicate that consistency in video analysis may make it preferable to standard goniometry. A larger, more comprehensive study is needed to provide conclusive results, including IMU data. These conclusive results could indicate that clinical use of video capture or IMUs should replace standard goniometry if other implementation hurdles can be reduced.