Measuring Humeral Torsion with Ultrasound Using a One-Person Technique Is a Reliable and Valid Technique
Hannah DC, Scibek JS, Carcia CR, Phelps AL: Duquesne University, Pittsburgh, PA

Context: Overhead throwing athletes typically present with altered ranges of motion of the dominant shoulder as a result of osseous and soft-tissue adaptations. Total arc of motion deficits are attributed to soft-tissue restrictions and have been linked to injury. Knowledge of the amount of humeral torsion (HT) enables clinicians to implement appropriate interventions for soft-tissue restrictions in order to restore motion and reduce injury risk. While the current ultrasound method (2PT) for measuring HT requires two trained assessors, a more efficient one-person technique (1PT) may be of value. Objective: To determine if a 1PT is a reliable and valid alternative to the established 2PT for indirectly measuring humeral torsion using ultrasound.

Design: Validation study

Setting: Biomechanics laboratory. Patients or Other Participants: Sixteen subjects (age = 26.9 ± 6.8 years; height = 172.2 ± 10.7 cm; mass = 80.0 ± 13.3 kg; sex = 7 males, 9 females) were recruited to participate in this study. Interventions: HT data were collected using both the 1PT and 2PT ultrasound techniques from a total of 30 upper extremities (16 left, 14 right). Each extremity was considered as an independent measure. Measurements from an upper extremity were excluded if the subject reported any known history of fractures to the forearm or humerus, elbow or shoulder surgery within the past 6 months, or diseases that could affect normal bony anatomy. Each investigator was blinded to the results recorded by the other investigator. Main Outcome Measures: For both techniques, within-session intrarater reliability (ICC3,1) was assessed using data from the first and third trials, while the standard error of measurement (SEM) was used to assess precision. Simple linear regression along with Bland-Altman plots were used to examine validity of the 1PT when compared to the established 2PT using the mean values from three trials, respectively. Alpha was set at ≤ .05.

Results: The mean HT measurement using the 1PT was 64.4° ± 9.5°, and 63.1° ± 9.6° for the 2PT. Both the 1PT (ICC3,1 = .992, SEM = 0.8°) and 2PT (ICC3,1 = .986, SEM = 1.1°) demonstrated excellent within-session intrarater reliability. The results of the regression analysis demonstrated a strong linear relationship between the HT measurements collected with both techniques (r = .963, r2 = 0.928, F1,28 = 361.753, P < .001). The mean of the paired differences between the two techniques was -1.2° ± 2.6°, and the 95% limits of agreement indicated the two techniques can be expected to vary between -6.3° to 3.8°.

Conclusions: The 1PT for measuring HT using ultrasound is a reliable and valid alternative to the 2PT. By reducing the number of testers involved, the 1PT may provide clinicians with a more efficient and practical means of obtaining this valuable clinical data.

Word Count: 450