ABSTRACT

Background: Range of motion (ROM) of the shoulder is an integral component of assessment of musculoskeletal shoulder impairments. ROM is typically measured using a universal goniometer (UG). The UG has demonstrated good intra and inter-rater reliability for measuring shoulder ROM, although limitations exist. In recent years, alternative measurement devices such as smartphone applications and digital goniometers have been introduced, potentially addressing some of the shortcomings of the UG. Limited research is available on the validity and reliability of these alternative devices, including the laser-guided digital goniometer, in measuring shoulder ROM.

Purpose: The purpose of this study was to investigate the intra- and inter-rater reliability and concurrent validity of a laser-guided digital goniometer (HALO) for measuring active shoulder ROM.

Methods: A convenience sample of healthy volunteers was recruited. To be eligible, participants were required to be between 18 and 75 years of age and able to actively move at least one shoulder into 90° of glenohumeral abduction. Self-report of previous significant shoulder injury; previous shoulder surgery; current bilateral shoulder pain; current neck or upper back pain; or referred pain into the upper extremity were exclusion criteria. Active shoulder flexion, abduction, internal rotation, and external rotation were measured for each shoulder. Two evaluators measured each motion twice with each device (HALO and the UG) per shoulder. The intra-class correlation coefficient (ICC) for reliability and validity/agreement between devices was calculated using a two-way mixed model with a 95% confidence interval.

Results: Data were analyzed for 75 shoulders from 41 participants (seven participants had only one shoulder evaluated). Intra-rater reliability ICCs are between 0.82 and 0.91 for the HALO, and 0.83 to 0.95 for the UG. Inter-rater reliability for the HALO was 0.89 to 0.98 and for the UG was 0.90 to 0.98. The ICCs for agreement, comparing the HALO digital goniometer to the UG ranged from 0.79 to 0.99.

Conclusion: This study provides evidence that the HALO digital goniometer can be a reliable and valid tool for measuring shoulder ROM in individuals with healthy shoulders. However, the two devices should not be used interchangeably to evaluate a single individual’s change over time for any motion.

Level of Evidence: Diagnostic Study (clinical measurement), Level 2b

Key Words: Clinimetrics, goniometry, reliability, shoulder, validity