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MEASURING SHOULDER EXTERNAL AND INTERNAL ROTATION STRENGTH WITH A HAND-HELD DYNAMOMETER, AND RANGE OF MOTION USING A GONIOMETER AND A DIGITAL INCLINOMETER: COMPREHENSIVE INTRA- AND INTER RATER RELIABILITY STUDY OF SEVERAL TESTING PROTOCOLSA Cools, L De Wilde, A van Tongel, D Cambier. *Ghent University, Gent, Belgium*

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Background Shoulder range of motion (ROM) and strength measurements are imperative in the clinical assessment of the overhead athlete in the prevention and rehabilitation of sports related shoulder injuries. The method and type of assessment varies among clinicians and institutions. Until present, no comprehensive study ever examined reliability of a variety of procedures based on different testing equipment, and specific patient or shoulder position.

Objective To establish absolute and relative reliability for several procedures measuring the rotational shoulder ROM and strength into internal (IR) and external (ER) rotation strength.

Design Controlled laboratory study.

Participants 30 healthy subjects (15 male, 15 female) with a mean age of 22.1 (± 1.4) years.

Risk factor assessment Subjects were examined by 2 examiners measuring ROM with a goniometer and inclinometer, and isometric strength with a Hand-Held-Dynamometer (HHD) respectively, in different patient's positions, and shoulder's positions. Relative reliability was determined by Intra-Class-Correlation coefficients (ICC). Absolute reliability was quantified by Standard-Error-of-Measurement (SEM) and Minimal-Detectable-Change (MDC). Systematic differences across trials or between testers, as well as differences among similar measurements under different testing circumstances were analyzed with dependent t-tests or ANOVA Repeated Measures (in case of 2 or more than 2 conditions respectively).

Main outcome measurements Range of motion (in degrees) and isometric muscle strength (in Newton).

Results Good to excellent intra- and intertester reliability was established for IR and ER ROM and isometric strength measurements, regardless of patient or shoulder position or equipment used (ICC 0.85-0.99). No systematic differences were found across trials or between testers. However patient's position, as well as equipment resulted in different outcome measures.

Conclusions All procedures examined showed acceptable reliability for clinical use. However, patient position and equipment might influence the results. For sport specific measurements, ROM and strength should be measured in positions, resembling the throwing position.



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