

Abstract

Proposal for the assessment protocols for different shoulder muscle groups

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Isokinetic dynamometers allow an accurate measurement of the strength developed by muscle groups surrounding different joints. Nevertheless, the particular shoulder complexity offers a great variety of testing positions and articular planes for the isokinetic examiners. Consequently, users must define valid protocols and determine the reproducibility of the main parameters. Because shoulder dysfunctions frequently affect the rotator cuff muscles, our study aimed at the elaboration of a reliable isokinetic assessment for the internal (IR) and external (ER) rotators and for the abductors (ABD) and adductors (ADD) in healthy subjects.

Ten male and ten female subjects (average age respectively 42 ± 5 years and 40 ± 4 years) without history of shoulder pathology participated in the study. Shoulder IR and ER were assessed using a Cybex Norm dynamometer in 90° of abduction in the frontal plane, the subject being in a lying supine position, at 2 angular velocities ($60^\circ \cdot s^{-1}$, $240^\circ \cdot s^{-1}$) in the concentric mode. In order to avoid the elevation of glenohumeral joint and elbow flexion during classical assessment, we proposed an original position and adapted protocol for ABD and ADD muscles. The subject was in lying lateral position, arm in the frontal plane, with a range of motion limited to 90° of abduction. Great care was taken to correctly align the glenohumeral center joint with the dynamometer axis. The new protocol proposed two speeds in the concentric mode ($60^\circ \cdot s^{-1}$ and $180^\circ \cdot s^{-1}$). For the reproducibility study, an interval of 10 days was inserted between the two sessions of measurement.

Through test-retest procedure, the coefficient of variation (CV) related to the rotators was included between

11% (IR at $240^\circ \cdot s^{-1}$) and 15% (ER at $240^\circ \cdot s^{-1}$). Concerning ABD and ADD, the CV ranged from 6% (ADD at $60^\circ \cdot s^{-1}$) to 13% (ABD at $180^\circ \cdot s^{-1}$). For the male dominant shoulder assessed at $60^\circ \cdot s^{-1}$, the greatest absolute peak torque was obtained in adduction (68 ± 12 N.m) followed by abduction (42 ± 8 N.m), internal rotators (34 ± 5 N.m) and external rotators (26 ± 4 N.m). The RE/RI and ABD/ADD ratio reached respectively $0.76 (\pm 0.07)$ and $0.63 (\pm 0.12)$ at $60^\circ \cdot s^{-1}$. In the male population, a dominant effect appeared for IR and ABD at high speed ($p < 0.05$). Female were systematically weaker than male (for all muscle groups in all conditions of assessment) and agonists/antagonists ratios remained similar in both populations.

Chronic pain of the shoulder could represent a relevant factor of disability and weakness [1]. Muscle shoulder assessment and rehabilitation, using isokinetic dynamometer, offer useful prospect [2]. With this end in view, validity and reproducibility of measurement constitutes a primary requirement. We showed, in this study, the satisfying reproducibility of the IR, ER, ABD and ADD peak torques. We also built a new valid test installation up for the ABD and ADD muscles.

References

- [1] J.L. Leroux, P. Codine and E. Thomas et al., Isokinetic evaluation of rotational strength in normal shoulder and shoulder with impingement syndrome, *Clin Orthop* **304** (1994), 108–115.
- [2] I. Holm, J.I. Brox and P. Ludvigsen et al., External rotation – best isokinetic movement pattern for evaluation of muscle function in rotator tendinosis. A prospective study with a 2 year follow-up, *Iso Exercise Sci* **5** (1996), 121–125.