Isokinetic strength ratios of the shoulder rotator muscles in elite swimmers

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Introduction
In the shoulder, rotator cuff balance is fundamental to maintain the humeral head centered in the glenoid cavity of the scapula. Isokinetic evaluation, as a routine method of strength testing, may constitute a tool to identify shoulder imbalances in athletes. Previous studies have calculated a ratio of external (ER) to internal arm rotation (IR) strength (ER:IR) (McMaster et al, 1992, Rupp et al, 1995, Bak & Magnusson, 1997). The purpose of this study is to investigate side-to-side balance and compare isokinetic strength characteristics in top level swimmers of both genders.

Methods
A group of 31 top-level competitive swimmers (13 female, 18 male). All the participants integrated the Portuguese national team. Mean age, height and body mass were, respectively, 19.91 (2.66) years, 181.09 (8.05) cm and 75.15 (7.81) kg for the male swimmers and 17.69 (2.07) years, 166.76 (2.74) cm and 56.74 (2.58) kg for the female swimmers. All swimmers reported being free from musculoskeletal shoulder injuries. Subjects warmed up for approximately 5 minutes before the testing session. Concentric strength measures for both dominant (D) and nondominant (ND) arms were performed on a Biodex Medical System isokinetic dynamometer at 60 and 180º/s. The subjects were seated with the elbow to body flexed to 90º and forearm perpendicular to the frontal plane. Rotation movements were performed between 15º of IR and 60º of ER. The peak torque values were corrected for gravity.

Results
In spite of a large range of ages, especially in the male group (17.25 – 28.08 years against 15.25- 23.58 in the female group), shoulder rotational strength was independent of decimal age in both genders. Results were within the range of values reported for swimmers in the literature. No significant differences were found when comparing side-to-side peak torque values for both angular velocities. All side-to-side measures showed strong correlation (p<0.01), indicating consistency of the testing procedures. The same was observed between angular velocities, for each arm and testing mode. As expected, female swimmers had significantly lower peak torques values at all the testing situations. The female group RE:IR ratio was significantly lower for the ND arm at 180º/s. A difference between testing at 60º/s and 180º/s was apparent for the male swimmers regarding the D arm and for the female swimmers regarding the ND arm. RE:IR ratios found in this study were lower for all testing modes than what is reported in Rupp et al (1995) but are similar to McMaster et al (1992).

Discussion/Conclusion
Discrepancy in ER:IR ratio values with Rupp et al (1995) can be explained by our different testing positioning of the arm (neutral position), which is associated with a decrease in the external rotation force compared with the abducted position, as was verified by Hinton (1998). The values of the ER:IR ratio reported for the nonathlete vary between 66% and 77%, and changes in this ratio is considered to be an indication of shoulder instability (Codine et al, 1997). However, the basis for the shift to lower ratios observed is likely to be sport-specific. Underwater stroke movements rely mostly on adduction and internal rotation actions, this way the external rotators remain almost unchanged but internal rotators are well developed by training. Nevertheless, the imbalance between ER and IR must be corrected by specific strength training in order to prevent the emergence of shoulder pathologies.

References