

Isokinetic strength ratios and range of motion of the shoulder rotator muscles in Portuguese male junior (16-18) tennis players

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INTRODUCTION: The goal of the present work was to characterize the shoulder muscle balance between the internal and external rotator muscles in Portuguese male tennis players (ages 16-18).

METHODS: 32 young male tennis players classified in the first 50 of the junior (aged 16-18) Portuguese ranking of 2005 participated in the study. Concentric strength measures of ER and IR for both arms were performed on a Biodex Medical System isokinetic dynamometer at 90 and 180°/s. During testing the subjects were seated, the arm was positioned in 45° abduction in the scapular plane and elbow flexed to 90°. Based on a reference position (0°) with the forearm horizontal, rotation movements were performed between 15° of IR and 60° of ER, with a 75° of range motion. The ROM of the ER and IR movements of both shoulders was passively measured by goniometry with the subject lying supine on a table with the arm abducted 90° and the elbow flexed 90°. Mean values and SD were calculated for the isokinetic force and amplitude parameters. To analyse dominant (D) to non-dominant (ND) arms differences the paired samples T test was used ($p < 0.05$). Correlation coefficients were measured to determine relationships between variables.

RESULTS AND DISCUSSION: With the exception of Peak Torque/Body Weight of ER, all the isokinetic parameters of ER and IR force were significantly ($p \leq 0.05$) higher in the D arm at both velocities. The mean values of ER:IR ratio observed in the D arm (0.61 ± 0.10 at $90^\circ \cdot s^{-1}$, 0.63 ± 0.09 at $180^\circ \cdot s^{-1}$) were lower than in the ND arm (0.67 ± 0.13 at $90^\circ \cdot s^{-1}$, 0.67 ± 0.11 at $180^\circ \cdot s^{-1}$) but significant differences were only found at $90^\circ \cdot s^{-1}$ ($p \leq .014$). With respect to shoulder flexibility, there was significant ($p \leq 0.0001$) less ROM of IR and significant ($p \leq 0.001$) higher ROM of ER in the D shoulder. The total rotation arc was significantly ($p \leq 0.05$) reduced in the D shoulder ($158.6 \pm 19.3^\circ$) when compared with the nondominant shoulder ($166.2 \pm 23.7^\circ$), meaning that the loss of IR in the dominant side exceeds the gain in the ER amplitude. Negative significant correlations were found between age and ROM of D ($r = -0.458$; $p \leq 0.01$) and ND arm IR ($r = -0.510$; $p \leq 0.01$). A positive significant correlation ($p \leq 0.001$) was found in the ROM between both shoulders in both movements, IR ($r = 0.787$) and ER ($r = 0.679$). We also found a positive correlation ($p \leq 0.05$) between shoulders in both velocities and movements for all the isokinetic force parameters (PT, PT/BW, TW, AP), indicating that, independently of the specific shoulder

adaptations produced by tennis training, the shoulder flexibility and strength depend on the individual characteristics.

CONCLUSIONS: Our results with Portuguese junior tennis players confirm adaptive changes in the dominant arm of tennis players (16-18): deficit in external rotator strength combined with loss in stretching capacity. Those adaptations may predispose the tennis player to shoulder instability and injury.