

# Isokinetic strength ratios of the shoulder rotator muscles in Portuguese male and female junior tennis players from national teams under 16 and under 18

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## Introduction

Overuse shoulder injuries are common in tennis players due to the repetition of fast internal rotation arm movements. The main reason for that is an imbalance between the internal rotator muscles that accelerate the arm and the external rotator muscles that decelerate and maintain shoulder dynamic stability. The purpose of this study was to isokinetically characterize the ratio of internal and external rotation strength (ER:IR ratio) at glenohumeral joint in a sample of junior tennis players from the national Portuguese teams.

## Methods

38 subjects participated in the study, divided in four groups: 14-16 years old males (n=11), 16-18 years old males (n=9), 14-16 years old females (n=11) and 16-18 years old females (n=7). All participants were players of the national Portuguese teams, free from shoulder injuries. Concentric strength measures for both dominant and nondominant arms were performed on a Biodex Medical System isokinetic dynamometer at 60 and 180°/s. The subjects were seated with the elbow to body flexed to 90° and forearm perpendicular to the frontal plane. Rotation movements were performed between 15° of internal rotation and 60° of external rotation. The peak torque values were corrected for gravity. Mean values and SD were calculated for the peak torque (in Newton-meters) and ER:IR ratio. To analyse side-to-side differences the paired samples T test was used, and to examine between-group differences to analyse the effect of age and gender we used the independent samples T test.

## Results

Table 1 displays the mean values of peak torque and of ER:IR ratios of muscle balance for dominant and nondominant arms in each group. When we consider all the subjects, the peak torque of IR was significantly ( $p<.001$ ) higher in the dominant arm in both velocities. When we analyse each group, the difference was significant ( $p<.05$ ) for all groups and both velocities, with the exception of the older females (16-18). The peak torque of the ER force was normally slightly higher in the dominant arm, but significant differences were found only in males.

	Males (14-16)		Males (16-18)		Fem. (14-16)		Fem. (16-18)	
	D	ND	D	ND	D	ND	D	ND
PT								
ER								
60°/s	25,04 (4,6)	23,63 (4,7)	32,43 (5,4)	32,02 (6,6)	18,91 (2,4)	18,53 (2,3)	21,43 (3,5)	20,64 (2,9)
180°/s	21,31 (5,6)	19,58 (5,5)	30,71 (7,1)	27,20 (5,6)	15,74 (3,7)	15,94 (3,0)	17,18 (4,3)	15,41 (3,2)
IR								
60°/s	43,39 (9,9)	37,12 (10,2)	53,89 (11,8)	46,17 (6,8)	34,46 (5,9)	29,57 (6,8)	38,43 (5,8)	37,11 (7,8)
180°/s	39,47 (9,5)	35,25 (8,0)	52,44 (11,5)	43,43 (8,6)	31,61 (6,6)	28,16 (6,5)	36,36 (6,4)	34,58 (8,1)
ER:IR								
60°/s	58,58 (7,1)	65,92 (14,0)	61,08 (6,4)	69,30 (10,0)	56,22 (10,8)	64,09 (7,9)	56,21 (8,9)	56,73 (9,1)
180°/s	54,25 (7,8)	55,80 (10,0)	58,58 (4,7)	63,23 (11,1)	52,57 (21,5)	59,28 (17,9)	47,20 (7,4)	45,19 (6,6)

A significant ( $p<.01$ ) lower ER:IR ratio was found in the dominant arm at both velocities, when we consider all the subjects. When we consider each group, significant differences were found only in the younger females (14-16) at 60°/s. No significant differences were found in the ER:IR ratio of the dominant arm between the 14-16 and the 16-18 groups, in men or women, or between men and women groups.

Table 1: Mean values and SD of peak torque (PT) in external and internal shoulder rotation and RE:RI ratio from dominant (D) and nondominant (ND) arms in the different groups.

## Discussion/Conclusion

The ER:IR values observed in the dominant arm, ranged from 47 to 61% with a significant lower ratio in the dominant arm than in the nondominant arm. Since external rotation peak values were not high, the increase in the internal rotation force explains the trend for a lower ratio in the dominant arm. These results confirm the literature reporting higher values for the internal rotators in the dominant arm of tennis players with no changes in the external rotators strength (Chandler et al., 1992, Codine et al., 1997, Ellenbecker & Roetert, 2002, 2003). However, the ratio we found was lower than the ratio measured in these studies. This can be explained by our different testing positioning of the arm (neutral position), that is associated with a decrease in the external rotation force compared with the abducted position, as was verified by Hinton (1988). Specific exercises for strength development of rotator cuff muscles are fundamental to guarantee the shoulder balance in these players.

## References

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