

ISOKINETIC ANALYSIS OF MEDIAL AND LATERAL ROTATORS RATIO OF GLENOHUMERAL JOINT IN MALE BRAZILIAN VOLLEYBALL TEAM

Luciana De Michelis Mendonça, Natália Franco Neto Bittencourt, Anderson Aurélio da Silva and Sérgio Teixeira da Fonseca

Laboratory for the Prevention and Rehabilitation of Sports Injury (LAPREV), Sports Excellence Center (CENESP), Federal University of Minas Gerais (UFMG), Belo Horizonte, Minas Gerais, Brazil

The purpose of this study was to analyze the ratio of medial and lateral rotators of glenohumeral joint in the male Brazilian Volleyball Team under 19 and 21 years-old. Twenty athletes under-19 and fifteen athletes under- 21, participated in this study. The Dynamometer Isokinetic Biodex 3 System Pro® was used to assess antagonist/agonist (RL/RM) ratio at 60°/s and 360°/s. A significant difference was found in ratio (RL/RM) between the categories, on the dominant limb ($F= 11,840$; $p=0,0016$ at 60°/s and $F= 7,00$; $p= 0,0124$ at 360°/s) and on the non-dominant ($F= 20,269$; $p= 0.0001$ at 60°/s and $F= 11,223$; $p= 0,0020$ at 360°/s). The under-21 athletes of Brazilian Volleyball Team presented RL/RM ratios below the expected values described in the literature.

KEYWORDS: shoulder, athletes, isokinetic.

INTRODUCTION:

The spike movement efficiency is a determinative element to reach high level performance in volleyball, considering the tactical aspect of the attack, as well as the high demand of this gesture in the conditioning of the athlete. A highly skilled attacker with 16 to 20 hours of weekly practice time spikes, for example, about 40.000 times a year (Forthomme & Croisier, 2005). Thus, great emphasis has been placed in the spike training, in which (Coleman et al., 1993; Forthomme & Croisier, 2005) repetitive movements in high speed occur many times in extremes range of movement (ROM), imposing great mechanical stress in the shoulder complex (Witrouw et al., 2005).. The muscles of the shoulder complex play an important role in endurance, force and power production, allowing the accomplishment of sports movement in a balanced and coordinated way, in consequence, these muscles keep the dynamic stability of glenohumeral joint. (Wilk et al., 1993; Alderink and Kuck, 1986; Ellenbecker and Mattalino, 1997). The force imbalance between agonist and antagonist shoulder muscles, has been pointed out as an important factor of risk for injuries in this joint (Gabriel and Patrick, 2002). Isokinetic evaluation is commonly used to evaluate muscles condition of health and injured athletes, allowing the comparisons of these isokinetic variables between athletes and non-athletes (Cools et al., 2005; Chandler et al., 1992; Codine et al., 1997). Isokinetic parameters can be used as injuries predictors, mainly the ratio between medial rotators/lateral rotators (RM/RL) Since in volleyball occur high speed rotations, it is necessary dynamic and balanced stabilization between the lateral and medial rotators of the glenohumeral joint. (Cools et al., 2005; Forthomme & Croisier, 2005). Therefore, the purpose of this study was to analyze the ratio of medial and lateral rotators of glenohumeral joint in the male Brazilian Volleyball Team under 19 and 21 years old.

METHODS:

Twenty athletes of the Volleyball Brazilian Team Under-19 and fifteen athletes under- 21, participated in this study. All athletes had signed a term of free assent for participation. The shoulder evaluations were part of an evaluation program promoted by the Sports Excellence Center (CENESP-UFMG), carried through in the Laboratory for the Prevention and Rehabilitation of Sports Injury (LAPREV). The subject's descriptive data are presented in table 1. The Dynamometer Isokinetic Biodex 3 System Pro® was used to assess antagonist/agonist (RL/RM) ratio at 60°/s and 360°/s. The protocol carried out during the test was five maximum repetitions of lateral and medial rotation of shoulder in the concentric-

concentric way at 60°/s and 30 repetitions at 360°/s. The antagonist/agonist ratio was calculated through the division of peak torque of shoulder lateral rotators muscles by the peak torque of the medial rotators muscles multiplied by 100. (18). Multiple analysis of variance (MANOVA) with one factorial level (categories) and another of repeated measures (dominant and non-dominant limb) was used to evaluate the dependent variable antagonist/agonist ratio at the two speeds. Analyses of contrasts were used to locate the specific pairs between which the difference was significant. The level of significance was established at $\alpha=0,05$.

Table 1 Subject's descriptive data

	Under-19	Under-21
AGE (years)	17± 0,5	19,4±0,7
WEIGHT (Kg)	85,6 ± 9	91,1 ±6,6*
HEIGHT (m)	1,96 ± 0,05	1,96 ± 0,06

RESULTS:

A significant difference was found in ratio between lateral rotators and medial rotators (RL/RM) between the categories, on the dominant limb (F= 11,840; p=0,0016 at 60°/s and F= 7,00; p= 0,0124 at 360°/s) and on the non-dominant (F= 20,269; p= 0.0001 at 60°/s and F= 11,223; p= 0,0020 at 360°/s) (Table 2).

Table 2 Mean and standard deviation of RL/RM ratio at 60°/s and 360°/s on the dominant and on the non-dominant limb in each group

	UNDER-19				UNDER-21			
	60° /s		360° /s		60° /s		360° /s	
	D	ND	D	ND	D	ND	D	ND
	74,01	78,95	79,72	88,52	62,76	64,23	64,76	69,58
RL/RM	1 ±	0 ±	2 ±	8 ±	5 ±	5 ±	5 ±	8 ±
RATIO	11,75	15,31	24,07	21,83	12,05	7,30	22,28	
(%)	0 ^a	8 ^b	5 ^a	5 ^b	0 ^a	^b	2 ^a	3,811 ^b

a= p< 0,05 between two groups on the dominant limb.

b= p< 0,05 between two groups on the non-dominant limb.

DISCUSSION:

In the literature exists a several references values for RL/RM ration of shoulder joint. According with Ellenbecker et al (1997), for non-athletes without shoulder injuries the ration RL/RM is around 66%. This exactly value was found by Chandler et al for the athlete population at 60°/s and 300°/s. Codine and collaborators (1997) found values of 70% for non-athlete at 60°/s, in the dominant limb, and 75% for non-dominant limb. At 300°/s, it has been found 75% for dominant limb and 81% for non-dominant one. Moreover, in this study, these data was compared with the ones of athletes of diverse modalities such as: runners(78% dominant limb and 83% for non-dominant at 60°/s and 75% in dominant and 84% in the non-dominant at 300°/s), tennis players (dominant 68% and non-dominant 74% at 60°/s and 67% in dominant and 76% in the non-dominant at 300°/s) and baseball players (61% for dominant limb and 71% for the non-dominant at 60°/s and 57% in dominant and 65% in the non-dominant at 300°/s). Thus, non-athletes and runners had the largest ratios, followed by tennis and baseball players, this difference is probably due to repetitive shoulder motion, such as throwing and volleyball spike that overloads the medial rotators, thus decreasing the RL/RM ratio values close to 60% at 60° /s. In sports such as tennis or running do not induce a predominance of one muscle group over another, in the same way it could be possible that

under-19 volleyball athletes in this study do not have muscles imbalance yet because they haven't had trained enough to induce this imbalance.

In addition, only the under-21 athletes had presented values below the reference ones for RL/RM ratio, having characterized a force deficit of lateral rotators and/or a force increasing of medial rotators. This result supports the specificity of the sport gesture, associated to a larger amount of training hours in this group.

Forthomme et al (2005) found that medial rotators (MR) strength could be correlated with increased spike velocity. Nevertheless, even if the lateral rotators (LR) strength is not critical for optimizing spike velocity, several authors (Wilk et al., 1993; Alderink and Kuck, 1986; Ellenbecker and Mattalino, 1997; Witrouw et al 2005) recommend correcting LR weakness and LR/MR imbalance, because a decreased LR/MR ratio is associated with shoulder injuries.

Further studies are needed to confirm those hypotheses and compare the muscular function of athletes with and without pathology to determine the exact role of muscles imbalance in tendinomuscular lesions.

CONCLUSION:

The data allowed setting parameters for shoulder muscles function through the isokinetic dynamometry in athletes from the Brazilian Volleyball Team under-21 and under-19, so it is possible to propose a preventive program of dysfunction caused by athletic activity. Besides this only under-21 athletes presented RL/RM ratios below the expected values described in the literature.

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