Research Paper

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Kinematic Characteristics of the Attack Spike in Female Volleyball Players Before and After Stretching

Education

KEYWORDS : static stretching, kinematic analysis, kinematics characteristics, volleyball

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ABSTRACT

The purpose of the present study was firstly to investigate the effect of static stretching on female volleyball players kinematics characteristics during volleyball spike from the back row defense, in position 1. Twelve female volleyball players (age 18-21, training age 6-10 years, height 178.17} 3.15 cm and weight 65.90 } 5.80 kg), volunteered as participants and they were randomly divided into two groups of 6 players. The exercise protocol involved a 5 minutes general warm-up, followed by the initial spike, followed by the static stretching of the upper limbs and followed by the final spike. The kinematics characteristics of the players during the initial and final spike, into 2 times (T) and 1 phases, were evaluated by a three-dimensional (3D) vinteoanalysis APAS. Paired t-test and Wilcoxon analysis showed significant difference and increase after the static stretching, of the right wrist displacement (DRWr) at the T 2 and 4 (p=0.014, p=0.039), of the left wrist displacement (DLWr) at the T 3 (p=0.012) and of the right wrist range of motion (RomRWr) at the first phase (p=0.037). Significant difference and reduction, after the static stretching, was found of the left shoulder angular velocity (VLSh) at T 4 (p = 0.024) and of the right wrist (VRKarp) at T 4 (p = 0.008, p = 0.017). No difference was observed on the kinematics characteristics of the lower limbs, on the total displacement (D) and the velocity of the center of body mass (CM), on the jump height and the speed of the ball. It is concluded that the volleyball players should avoid static stretching before the competition.

INTRODUCTION

The static stretching during warm-up is considered a classic process in sports coaching and improves the flexibility of joints players before work out or game.

Although there have been several investigations so far for the effect of static stretching on performance, the results are conflicting. Improvements in performance after the application of static stretching for several weeks indicate Worrell et al. (1994), Kokkonen and Lauritzen (1995), and Handel, Horstmann, Dickbuth and Guich (1997).

Torres et al. (2008) performed static stretching of a total duration of 30 seconds, twice for 15 seconds (2x15) in athletes of track and field and found no effect in maximum strength and throwing in the upper limbs.

The effect of static stretching of the upper limbs was examined by Haag, Wright, Gillette and Greany (2010) on the speed of the ball pitching in baseball and serve in tennis by Knudson, Noffal, Bahamonde, Bauer and Blackwell (2004). In athletes of Baseball the duration of dilatation of the upper limbs was performed 30 seconds and in tennis players performed twice for 15 seconds (2x15).

These authors found no act positively or negatively static stretching speed throwing the ball, as the speed of the ball on serve.

Unlike the above researchers, Winchester, Nelson and Kokkonen (2009) in college students found negative impact on maximum force of the hamstring muscles after static stretch ranging from 30 to 180 seconds.

In sports especially volleyball during the warm up even today static stretching inserted between the general and specific part (Young &Behm, 2002), because the static stretching is considered a key component improving flexibility (Harvey, Herbert, &Crosbie, 2002, Knudson, Magnusson, & McHugh, 2000), performance (Worrell, Smith, &Winegardner, 1994), the prevention of muscle injury (Safran, Seaber, & Garrett, 1989), and the reduction of muscle injury (Smith, 1994). These improvements contribute to flexibility the performance of game movements with biomechanical precision providing production of maximum forces across the range of kinematic joints (Van Gyn, 1986).

Many studies refer to the benefits resulting from the application of static stretching however recent studies indicate negative performance in the sprints, jumps and power of the lower limbs. While, i.e., the majority of studies focused on the effect of static stretching of the lower ends and fewer listed in the upper extremities.

METHODS

Participants

Twelve female volleyball players (age 18-21, training age 6-10 years, height 178.17} 3.15 cm and weight 65.90} 5.80 kg), volunteered as participants and they were randomly divided into two groups of 6 players

SAMPLE NUMBER	(N = 12)
AGE (years)	19,75 ± 0,7
COACHING AGE (years)	7,33 ± 1,6
HEIGHT centimeters (cm)	178,17 ± 3,15
Kg WEIGHT (Kg)	65,90 ± 5,80

3D kinematic analysis

For the kinematic analysis of the spike was used the three-dimensional (3D) video analysis, Ariel Performance Analysis Systems (APAS). This program is a traffic analysis carried out by the computer / PC for measurement, analysis and presentation of execution of movement. H three-dimensional motion analysis consisted of three phases, which were: 1) the motion capture, 2) digitization, and 3) the calculation of the data.

Procedure

The athletes were divided randomly into two groups of six people in the volleyball court for the execution of the exercise protocol. This included: a general warm-up 5 minutes (1), the initial implementation of the aggressive movement of the spike (2), static stretching (3), and final execution of the aggressive movement of the spike (4).

1) The general warm-up consisted of running 5 minutes of low intensity around the boundaries of the field volleyball, lateral movements of the body and running in different directions.

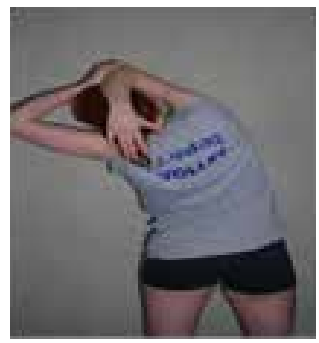
2) The athletes arrive in random order on one side of the field in attack and one to execute the aggressive movement of the spike. An assistant from position 5 gave the ball to the setter, who was near the net in position 3 the setter passes the ball to the athlete by pass behind the head. The athlete execute a spike to the predetermined area of attack measures dimensions 4X3. The landing of the ball after the spike was on the opposite side of the field the predetermined region of size 9x3 meters. The athletes performed three consecutive attacks and evaluated the best. As best effort was evaluated, in which the ball was faster after hitting. The fixed seating in the territory identified with adhesive tape.

3) The players performing static stretching duration 15 seconds, alternating between the upper ends of each muscle group, which was repeated four times (4x15). The muscle groups they claim was the serratus anterior, deltoid, the pectoralis major, triceps brachial, the latissimus dorsi, the teres major, the subscapularis (Dupuis & Tourny-Chollet, 2003) and forearm. The total duration of stretching was 10 minutes. The players felt the great elongation of muscle maintains, without muscle pain.

Stretching

Picture 4 stretching exercises pectoralis major and subscapularis muscle

Picture 5 stretching exercises triceps, deltoid, teres major and latissimus dorsi muscle



Picture 6 stretching exercises latissimus dorsi, brachial triceps, subscapularis, teres major and serratus anterior muscle

Figure 7 stretching exercises of the wrist extensor muscles

Picture 8 Exercise distension abdominal flexor muscle of wrist

4) The final implementation of the spike was like the second part.

Variables

This investigation determined the kinematic characteristics for the following time points were

1) Phase (X.S) 4, in which the bent elbow driven higher by the wrist, above the height of the head

Picture 9 Phase (X.S) 4

2) Phase (X.S) 5, which runs on hitting the ball

Picture 10 Phase (X.S) 5

The variables were evaluated for the above five times was

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1), the velocity of the center of body mass (K.M.S) in horizontal, vertical axis (x, y, respectively).

2) the amplitude (D) and angular velocities (V) of the joints and

Also determined kinematic characteristics for the following stage was the phase lasting from the time of 4 to 5 at the time, (XS4 toXS5)

Statistical analysis

For statistical data analysis used the statistical package SPSS 18 (Statistical Package for the Social Sciences) and was analyzed paired t-test (initial-final measurement). To control the regularity of the data distribution test was used Shapiro-Wilk, for samples with less than 50 people. Where the normal distribution (bell-shaped distribution) prices was not fulfilled, used the non-parametric Wilcoxon. The level of significance was set at p <0.05.

RESULTS

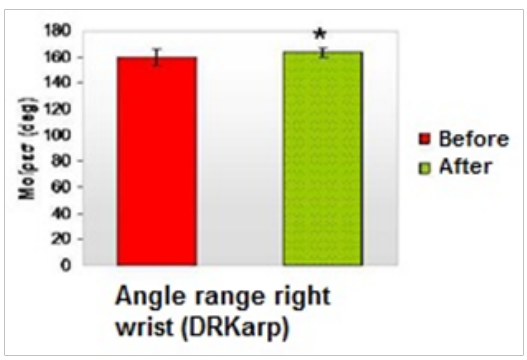

Figure 1. Angle range right wrist (DRKarp), before and after static stretch Phase (X.S) 4 (* = statistically significant at p <.05)

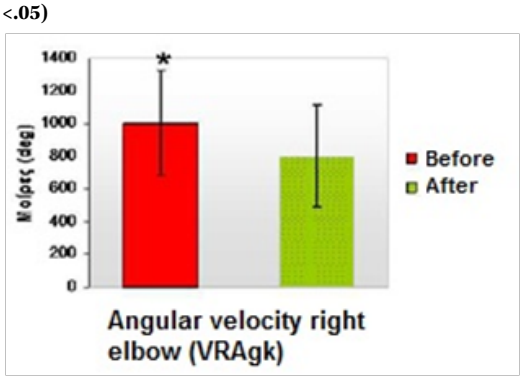

Figure 2. Angular velocity right elbow (VRAgk), before and after the static strech Phase (X.S) 4 (* = statistically significant at p <.05)

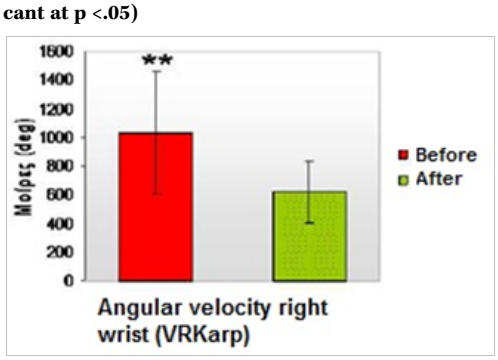

Figure 3. Angular velocity right wrist (VRKarp), before and after static stretch Phase Phase (X.S) 4 (= statistically significant at p <.01)**

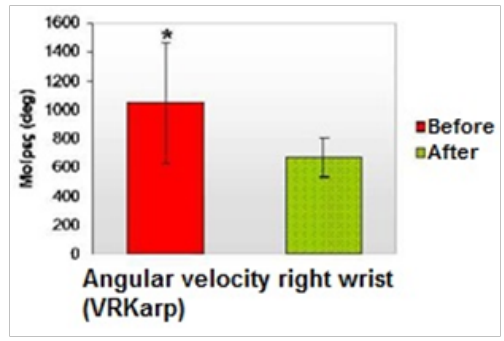

Figure 4. Angular velocity right wrist (VRKarp), before and after static stretch Phase (X.S) 5 (* = statistically significant at p <.05)

DISCUSSION

The present study was designed to investigate the effect of static stretching on kinematic characteristics volleyball athletes during the attack spike, as they tend to incorporate static stretching during the warm-up. The results of this study showed no differences in the range of the angle and angular velocity of the joint at a particular time, and the range of motion of the joints of the lower limbs, the displacement and velocity of the center of body mass relative to the axes x, y and the height of the jump. These results were expected, since applying the static stretching involved only the upper limbs and the lower limbs not.

The results of this study shows an increase of the amplitude of the joints of the right wrist at the time 4, wherein the elbow is above the wrist, It also found a decrease in the angular velocity of the right elbow and wrist at the time 4 and the right wrist by hitting the ball (time 5), after application of static stretching, in accordance with the protocol applied, confirming the first research hypothesis.

Our results are consistent with similar results from other researchers (Kokkonen, et al., 1998, Fletcher & Jones, 2004, Noffal et al., 2004), who found negative effects on the ability of the maximum force in the sprints, jumps and castings.

In this investigation, the static stretching had a total duration of 60 seconds and performed four times for 15 seconds (4x15). The reductions observed after static stretching were the angular velocity of the left shoulder at time 2, the right elbow and wrist at the time and four further time 5 for just the right wrist.

The conflicting results may be due to different methodological approach. In this study, static stretching had a total duration of 60 seconds and performed four times for 15 seconds (4x15), while the investigation of Torres et al. (2008), Haag, et al. (2010) and Knudson, et al. (2004) was of shorter duration (30 seconds). While the Molacek, et al. (2010) was smaller but longer duration of 60 seconds of this research.

CONCLUSION

Based on the limitations of this research, the results suggest that static stretching a total of 60 seconds in the upper extremities, negatively affects the kinematic characteristics of volleyball athletes. While it was initially suspected that static stretching would cause changes in the speed of the ball, this was not observed in this investigation.

Moreover alter the range of motion and hence also the technical execution of upcoming skills. Given that the largest reductions in kinematic characteristics observed in articulation with the highest values of angular speed up to avoid static stretching during warm-up, just before the upcoming racing activity and especially in sports that require quick and explosive movements.

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