

Electromyographical Analysis of Hitting Arm during Spike in Volleyball



Dr. Amar Kumar*

Assistant Professor,
Lakshmibai National Institute of Physical Education,
Gwalior

Prof. S. Mukherjee**

Professor,
Lakshmibai National Institute of Physical Education,
Gwalior

ABSTRACT

The purpose of the study was to investigate the electrical activity of selected muscles during spike using electromyography on Inter-University players of volleyball. In volleyball, spike is the most exciting technique which every player likes. In this study fifteen male subjects ranged from Eighteen to Twenty Four years were selected as the subjects from Lakshmibai National University of Physical Education, Gwalior. These all players had represented Inter-University level and they had no upper extremity injuries or any bone or joint disparities within the past years. By reviewing the literature and consultation with experts, the research scholar carried out an intensive study and selected variables were Anterior Deltoid, Medial Deltoid, Biceps Brachii and Triceps Brachii. The criterion measure adopted for this study was measured by Bio Tech Thought Technology of Eight channel. After a brief warm-up, and electrodes placement according to SENIAM guidelines and then participants allowed to perform the spike. Three times data were recorded and the best was considered for data. Descriptive statistical and percentile technique were used to find out the muscles, which were more significant during Contact Phase in volleyball. The level of significance was set at 0.05. The findings of the study clearly revealed that electrical activity of Anterior shoulder muscle showed highest activation level of EMG during Contact phase in selected muscle groups. Anterior shoulder muscle and triceps showed high activation which helps to hit the ball more powerfully as they were considered to be prime movers in the hitting phase of spike. Due to coupling force at shoulder joint the contact with the ball is very important, otherwise shoulder injury may take place due to excessive stress on shoulder joint. Whereas other selected muscle like medial deltoid and biceps brachii showed less electrical activation in respect to their maximum voluntary contraction. Hence, spiker should contacts the ball at particular position means in front of the shoulder muscle to increase efficiency and effectiveness of spiking and also include strength training of contributory muscles

Key Words- Electromyography, Spike, Anterior Deltoid

INTRODUCTION

Spike considered to be very attractive and most explosive action in the volleyball game. The concentric action of muscles functioning during the hitting phase is prepared by a preceding eccentric action that occurs during the loading phase. At the moment of the contact with the volleyball the upper limb is typically abducted to 150- 180, slightly flexed to contact the ball out in front of the body and extended at the elbow (to permit contact with the ball at the highest possible point) Furthermore, for skills such as the spike in which the athlete follows more or less programmed approach to the ball, the extensor muscles are activated in preparation for the loading phase, thereby, stiffening the joints of upper limbs

in anticipation of contact. This position also maximizes the moment arm of the upper limb, resulting in faster arm swing and a more powerful spike. A powerful hit is possible only if the transition phase between eccentric preloading and reflex concentric activation is short. Concentric potentiating occurs only if the transition is fast or "reactive". If the transition is slower or delayed no enhancement of the concentric phase occurs (Reeser, 2003)

The spiking action in volleyball may be viewed as a complex pattern consisting of approach run, take off, execution and landing. In order to design optimal skill development and conditioning program for the shoulder strengthening in the game of volleyball. It is first necessary to gain a clear understanding of the movement patterns and muscle involved in the performance of spiking especially shoulder muscles in the volleyball game. To understand all about this complex area the research scholar has undertaken the present study

METHODOLOGY

Participants and Variables

Fifteen male Inter-University Volleyball players of the Lakshmibai National University of Physical Education, Gwalior were selected as subjects for the study. Hence, purposive sampling was considered for selection of subjects. The age level of subjects ranged from eighteen to twenty-four years. These all players had represented Inter-University level and they had no upper extremity injuries or any bone or joint disparities within the past years. By reviewing the literature and consultation with experts, the research scholar carried out an intensive study and selected various major muscles. The following muscles were selected for the study.

1. Anterior Deltoid (Striking Arm)
2. Medial Deltoid (Striking Arm)
3. Biceps Brachii (Striking Arm)
4. Triceps Brachii (Striking Arm)

Procedure

The data for the selected muscles were obtained with the help of the instrument Bio Tech Thought Technology of Eight channels. The data were recorded in micro volt (μV) by the investigator at take-off of spike in volleyball. Before the actual testing, the subjects were given a complete demonstration of each test and the purposes of the test were explained in detail to them. After the demonstration and explanation, electrode points were marked in the presence of university physiotherapist and then subjects were allowed to practice trials in the performance test in order to get familiarized with the test. The data were collected in different phases of spike i.e., Contact Phase of spike in the volleyball court of Lakshmibai National University of Physical Education, Gwalior. On the day of testing each subject was oriented to the testing protocol. The protocol was sequenced as:

1. Warm-up
2. Electrode Placement
3. Practice and Familiarization
4. MVIC(Maximum Voluntary Contraction) Protocol
5. Exercise Protocol

Warm-up

Proper time were given to the subjects for general warm-up as well as for specific warm-up. Each subject repeatedly performed spike in well manner during warm-up.

Electrode Placement

Site preparation for the Electrode – Interface included shaving of the area, followed by abrasion using an alcohol soaked

pad, rubbing the site of electrode application vigorously. A slightly abrasive pad was used. The skin preparations were elicit a slight histochemical effect. (Dr. Scott, 2007).

Practice and Familiarization

Sufficient practices were given for the better performance and the better recording of data.

MVIC (Maximum Voluntary Contraction)

Each subject performed three 4 second maximum voluntary isometric contraction for each of the four muscles. (SENIAM Guidelines)

Exercise Protocol

The spiking skills of different subjects were performed at Lakshmibai National University of Physical Education, Gwalior. The subjects performed the skill three times. The best trial was recorded.



Statistical Analysis

Descriptive statistical and percentile technique were used to find out the muscles, which were more significant during Contact phase of spike in volleyball. The level of significance was set at 0.05.

Table -1

Percentile and Descriptive Statistics of Muscular Electrical Activity of Hitting Arm during Contact Phase in Spike in Volleyball

S. No.	Name of Selected Muscles (Hitting Arm)	Electrical Activity of Muscles in % of MVIC	Mean value and standard deviation of RMS of each muscles in microvolt (μv)
1.	Anterior Deltoid (A.D)	81-87%	482.43 \pm 21.23
2	Medial Deloid (M.D)	70-75%	269.95 \pm 18.14
3.	Biceps Brachii (BICR)	54-65%	198.9 \pm 13.55
4.	Triceps Brachii (TRICR)	80-83%	157.74 \pm 18.62

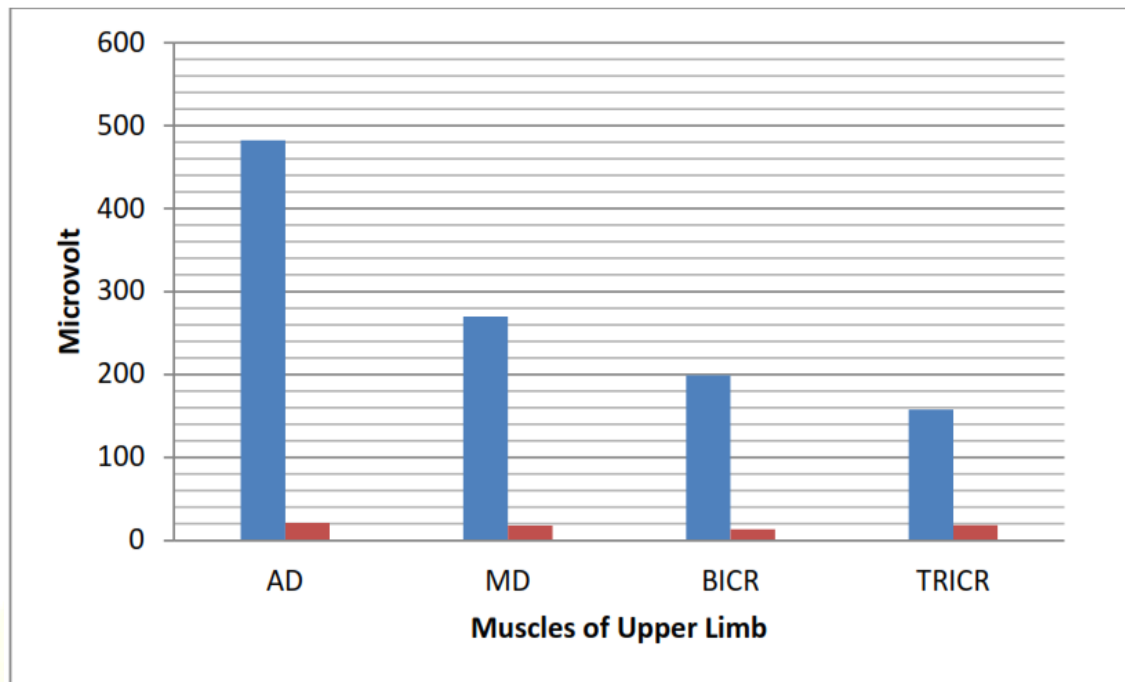


Fig-1

Graphical representation of Mean and Standard deviation of Electrical Activity (μv) of selected Muscles during Contact Phase in spike in Volleyball

RESULT AND DISCUSSION

The findings of the study clearly revealed that electrical activity of Anterior shoulder muscle showed highest activation level of EMG during Contact phase in selected muscle groups. Anterior shoulder muscle and triceps showed highest activation which helps to hit the ball more powerfully as they were considered to be prime movers in the hitting phase of spike. Due to coupling force at shoulder joint the contact with the ball is very important, otherwise shoulder injury may take place due to excessive stress on shoulder joint. Hence, spiker should contacts the ball at particular position means in front of the shoulder muscle to increase efficiency and effectiveness of spiking and also include strength training of contributory muscles

During contact phase the shoulder moves through a wide range of motion at high speed. Significant forces are generated in the upper limb, placing the shoulder girdle at great risk of injury. Hence, it is advised to strengthen the shoulder muscle to execute the technique more explosively and at the same time to learn proper execution of the skill. Whereas other selected muscle like medial deltoid and biceps brachii showed less electrical activation in respect to their maximum voluntary contraction as the shoulder is abducted at the moment of cocking phase and biceps helps as stabilization of elbow joint during the hitting phase. Jonathan C. Risser et al. also supported the result.

Therefore, from the above findings it is evident that those specific muscles (Anterior shoulder and triceps of hitting arm) which have greater role at the time of contact during spike in volleyball give more consideration while constructing the training program to develop the performance of spike and to avoid injury.

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Corresponding Author

Dr. Amar Kumar*

Assistant Professor, Lakshmibai National Institute of Physical Education, Gwalior



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