Electromyographical Relationship of Jump Serve Performance among the Volleyball Players

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Abstract

The purpose of the study was to investigate the relationship of muscular contraction of selected muscles during Jump Serve among national and university level Volleyball players. The subjects for the study were twenty male Volleyball players from Lakshmibai National Institute of Physical Education & Jiwaji University, Gwalior. The muscular contraction of selected muscles was measured by biotech though technology of six channels and the Jump Serve performances of subjects were assessed by 5 point scale through subjective judgment of panel of judges. The data was analyzed using the Spearman's Rank correlation (ρ). The level of significance was set at 0.05. The above mentioned statistical techniques were performed using SPSS version 17.

KEYWORDS- Electromyography, Jump Serve, Volleyball

INTRODUCTION

Play begins when the ball is served by the right-back player. The serve must be executed from the serving zone, and ball must be hit with one hand or any part of the arm. The distance behind the end line is limited only by tactical considerations or free space. The simple objective of serving is to put the ball into play by getting it over the net. At an advanced level of play, the serve becomes an important element of the team's attack and overall strategy, and is often a chance to gain a point (Arie Selinger 1985).

The process of electromyography involves the use of transducers known as electrodes that sense the level of myoelectric activity present at a particular site over time. Depending on the questions of interest, either surface electrode of fine wire electrodes is used. Surface electrodes, consisting of small discs of conductive material, are positioned on the surface of the skin over a muscle or muscle group to pick up global myoelectric activity. When more localized pickup is desired, indwelling, fine wire electrodes are injected directly into a muscle. Output from the electrodes is amplified and graphically displayed or mathematically processed and stored by a computer (Susan J. Hall 1999).

Since, the research scholar conceptualized to investigation the relationship of muscular contraction of selected muscles with the performance of jump serve of Volleyball players. The study was delimited to the twenty male Volleyball players. The subjects were further sub-categorized in two group's viz. National and University of 10 subjects each. The electromyographical instrument was of six channels only. The study was further delimited to the following muscles i.e. Rectus Femoris (RF), Vastus Lateralis (VL), Vastus Medialis (VM), Gastrocnemius (GCM), Anterior Deltoid (AD), Medial Deltoid (MD), Triceps Brachii (TB), Gluteus Maximus (GM). The study was further delimited to only two phases of serve i.e., 1) Take-off and 2) Execution (hitting). The study is further delimited to common-mode rejection ratio of 110 dB at 50-60 Hz.

On the basis of scientific facts and research scholars own understanding it was hypothesized that there would be significant relationship of muscular contraction of selected muscles with the performance of jump serve in Volleyball.

METHODOLOGY

Anatomical landmarks of selected muscles were marked by palpation method for electrode application in different phases. The data of Jump Serve were collected in the Biomechanical Laboratory of LNIPE, Gwalior. Muscles activities were measured by Bio Tech Thought Technology of six channels in micro volt (µv) and performance of Jump Serve was measured by 5 point scale through subjective judgment of three qualified judges.

Fig. 1: Electrode Placement

EMG Equipment and Processing - Muscle activity of the right and left Vastus Lateralis, Vastus Medialis, Gluteus Maximus, Gastrocnemius, Anterior deltoid, Triceps Brachii, Rectus Femoris & Medial deltoid was recorded using Ag/AgCl surface electrodes and data were expressed in microvolt (µv). The raw EMG baseline level was located at 1 to 3.5 microvolt. The "Common Mode Rejection Ratio" (CMRR) for the present study was 110 dB. For EMG almost all of the signal power is located between 10 to 250 Hz and scientific recommendations require an amplifier band setting 10 to 1500 Hz. This would result in a sampling frequency of at least 1500 Hz to avoid signal loss. Maximum Voluntary Contraction (MVC) was used to normalize the reference value of a reference contraction. After an initial warm-up sequence (stretching, low aerobic exercise, 5 to 10 minutes) subjects were asked to start slowly increasing the force, reach the maximum effort after 3-5 seconds hold it for 3 seconds and calm down after 3 seconds. Same sequence was repeated for each MVC contraction.

Fig. 2 : Electromyography Instrument

Exercise Testing Protocol The subjects were asked to wear appropriate clothes for EMG testing. The skin of the subjects were clean with abrasive fluid i.e. Maptron's Ultrasound Transmission Gel. Electrodes were attached parallel to the muscles fibre and wait at least 3 minutes for application area to reach a sable electrical condition. The subjects were instructed to begin the technique and electrical activities were recorded.

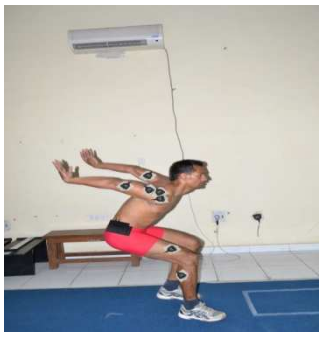

Fig. 3 : Take-off Phase

On the basis of expert guidance 5 points scale was employed to assess the performance of Jump Serve among the volleyball players by subjective judgment of three qualified judges. The average of highest point given by each judge's was considered as the final score.

RESULTS

Table - 1
EMG RELATIONSHIP WITH JUMP SERVE PERFORMANCE WITH NATIONAL AND UNIVERSITY VOLLEYBALL PLAYERS

MUSCLES	NATIONAL PLAYERS			UNIVERSITY PLAYERS		
	Mean	SD	Coefficient Of Rank Correlation (P)	Mean	SD	Coefficient Of Rank Correlation (P)
RFR	638.00	20.56	.800*	623.30	31.97	.650*
RFL	639.30	8.69	.775*	590.67	52.52	.667*
VLR	563.16	30.87	.738*	542.52	24.52	.406
VLL	136.81	8.53	.488	118.16	5.92	.644*
VMR	580.05	28.82	.657*	572.98	30.69	.238
VML	599.42	15.04	.469	599.92	10.54	.788*
GCMR	534.66	19.23	.394	526.01	9.63	.725*
GCML	586.61	15.20	.757*	585.38	15.27	.544
ADR	546.37	12.96	.331	541.75	7.11	.825*
ADL	506.77	12.09	.506	501.32	12.15	.750*
MDR	340.84	12.83	.675*	328.64	17.10	.506

MDL	348.60	18.77	.363	344.05	16.43	.513
TBR	184.92	8.81	.619	191.36	27.08	.713*
TBL	101.17	9.65	.557	91.26	9.86	.223
GMR	278.60	30.67	.781*	289.60	24.05	.632
GML	280.52	28.33	.832*	285.79	13.88	.188

*Significant at 0.05 level.
Tab. $\rho_{.05}$ (8) = 0.643

It was evident from table-1 that co-efficient of rank correlation of Rectus Femoris right, Rectus Femoris left, Vastus lateralis right, Vastus medialis right, Gastrocnimius left, Medial Deltoid Right, Glutius Maximus right, and Glutius Maximus left muscles with the National Volleyball player's performance of Jump Serve at the moment take-off were .800, .775, .738, .657, .757, .675, .781 and .832 respectively, which were significant at 0.05 level of significant with 8 degree of freedom. It indicates that there were significant relationship of muscular contraction of above said muscles with the National Volleyball player's performance of Jump Serve at selected moment i.e. take-off.

It was also evident from table-1 that co-efficient of rank correlation at rectus femoris right, rectus femoris left, Vastus Latralis left, Vetus Medialis left, Gastrocnimius right, Anterior Deltoid right, Anterior Deltoid left and Triceps Brachii muscles with the University Volleyball player's performance of Jump Serve at the moment take-off were .650, .669, .644, .788, .725, .750 and .713 respectively, which were significant at 0.05 level of significant with 8 degree of freedom. It indicates that there was significant relationship of muscular contraction of above said muscles with the University Volleyball player's performance of Jump Serve at the moment take-off. The graphical representation of mean of EMG among the volleyball players were presented in fig 4.

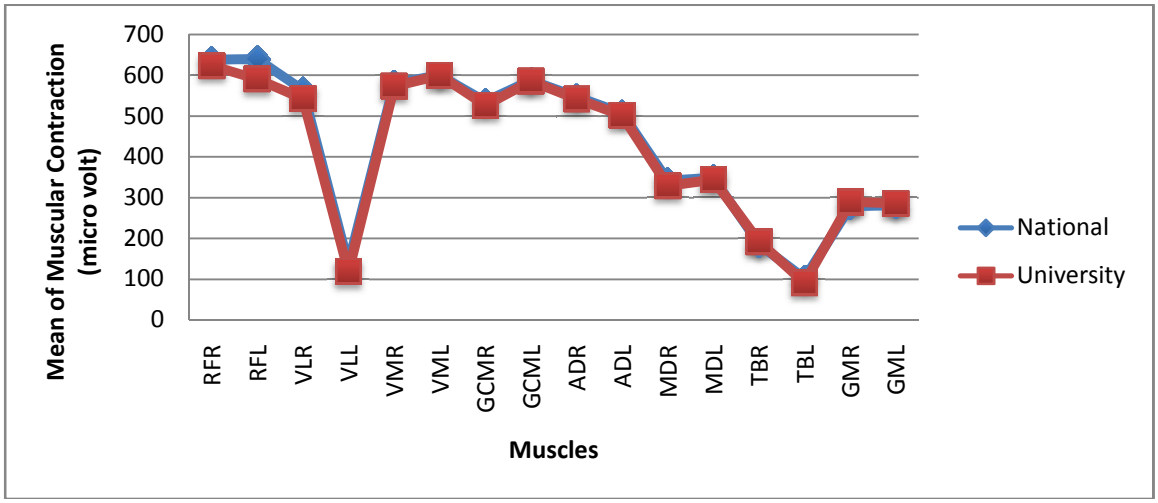

Fig. 4 : Mean of selected Muscular Contraction among National and University Volleyball players

DISCUSSION

The study was conceptualized with a purpose to investigate the muscular involvement in different body segments and force of muscular contraction during Jump Serve in Volleyball.

The statistical findings showed that there was a significant relationship of muscular contraction of Rectus Femoris Right, Rectus Femoris Left, Vastus Lateralis Right, Vastus Medialis Right, Gastrocnemius Left, Medial Deltoid Right, Gluteus Maximus Right, Gluteus Maximus Left muscles with the performance of jump serve at the moment take – off of National Level Volleyball players. Similarly, significant relationship of muscular contraction of Rectus Femoris Right, Rectus Femoris Left, Vastus Lateralis Left, Vastus Medialis Left, Anterior Deltoid Right, Anterior Deltoid Left and Triceps Brachii Right muscles with University Level Volleyball Players of jump serve at the moment take – off.

The statistical significance pertaining to the relationship of muscular contraction of selected muscle group with the performance of Jump Serve at the moment take – off could be attributed the fact that selected muscle group play a dominating role at the moment take – off during jump serve. Jump Serve has become an increasingly important offensive weapon in Volleyball. To execute the jump take – off is crucially very important for converting horizontal momentum to vertical momentum. The muscles namely Rectus Femoris, Vastus Lateralis, Vastus Medialis, Gastrocnemius, Anterior Deltoid, Medial Deltoid, Triceps Brachii, Gluteus Maximus plays a contributory role in the preparatory phase (take – off) of Jump Serve. The goal of an effective jump serve is to generate maximum force through a series of muscular contractions and joint actions i.e. transferred from the ground through the entire body, up the arm and through the final wrist snap. The result of the study was in agreement with the work of Walls (1991) and the finding of the present study support the finding of the study conducted by Cisar et al (1989).

On the basis of research findings and scientific facts available the hypothesis stated earlier that there would be significant relationship of muscular contraction of selected muscles with the performance of jump serve in Volleyball was accepted.

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