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Electromyographic Analysis of Chest and Back Muscles and their Correlation with the Performance of Jump Tennis Service in Volleyball

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Original Research Article

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Abstract: The Purpose of the study was to EMG Analysis of Chest and Back Muscles and their Correlation with the Performance of Jump Tennis Service in Volleyball. Coverage/ Selection of Subjects: Universe of the Study: The study was confined to India only. Sampling Frame: Subjects were selected as a sampling frame from India only and their age was ranging from 16 to 28 years. Sampling Methods: Subjects were selected on the basis of purposively random sampling method. Sampling Size: A total of 12 male professional Volleyball players from India were selected for the study. Units of Observation: Observations were made on the following Variables/contents: Pectoralis Major (PMJ), & Trapezius (TP). Criterion Measures: Muscles activities during jump tennis service in volleyball were measured by Neuro Trac Myo Plus 4. The data was recorded in micro volt (μv). Statistical Techniques: The concerned data was analyzed by using descriptive statistical in order to electromyographic analyses of chest & back muscles during executing the jump tennis service in volleyball. In order to determine the relationship of selected (chest & back) muscles activities with the performance of jump tennis service in volleyball, Pearson Multiple Correlation Technique was used. The level of significance for the entire analysis was set at the 0.05 level. Conclusions: According to finding the study, Trapezius muscle showed the highest activation level of EMG during execution of jump tennis servive in Volleyball. Pectoralis muscles showed the 5th highest activation level of EMG during execution of jump tennis service in Volleyball. Only one muscles group that is Pectoralis is found correlated with the performance of jump tennis service in Volleyball. The insignificant relationship was found between back (Trapezius) muscles and with the performance of jump tennis service in Volleyball.
Keywords: Electromyographic Analysis, Chest & Back Muscles & Tennis Service.

INTRODUCATION

EMG- Electromyography

The electrical signal associated with the contraction of a muscle is called electromyogram or shorthand name EMG. The study of EMG is called electromyography. Electromyography (EMG) is the science of quantifying muscle activity. Several studies have reported shoulder muscle activity during a variety of upper extremity sports. Understanding when and how much specific shoulder muscles are active during upper extremity sports is helpful to physicians, therapists, trainers and coaches in providing appropriate treatment, training and rehabilitation protocols to these athletes, as well as helping health professionals better understand the shoulder injury mechanism. When interpreting EMG data it should be emphasized that while the EMG amplitude does correlate reasonably well with muscle force for isometric contractions, it does not correlate well with muscle force as muscle contraction velocities increase, or during muscular fatigue (both of which occur in sport). Nevertheless, EMG analyses are helpful in determining the timing and quantity of muscle activation throughout a given movement. shoulder muscle activity in upper extremity sports, specifically: baseball pitching, American football throwing, windmill softball pitching, the volleyball serve and spike, the tennis serve and volley, baseball hitting, and the golf swing. Most of the movements that occur in the aforementioned sports involve overhead throwing type movements. Shoulder EMG data in the literature are far more extensive for overhead throwing activities, such as baseball pitching, compared with other upper extremity sports that do not involve the overhead throwing motion, such as baseball hitting. Therefore, much of this review focuses on shoulder EMG during activities that involve the overhead throwing motion. To help better interpret the applicability and meaningfulness of shoulder EMG data, EMG data will be integrated with shoulder joint kinematics (linear and angular shoulder displacements, velocities and accelerations) and kinetics (shoulder forces and torques) when these data are available [1].

In human anatomy, the trapezius is one of two large superficial muscles that extend longitudinally from the occipital bone to the lower thoracic vertebrae and laterally to the spine of the scapula (shoulder blade). Its functions are to move the scapulae and support the arm.

Pectoralis major is a thick, fan-shaped muscle, which makes up the bulk of the chest muscle. It lies under the breast. It serves to flex, extend, and rotate the humerus, the long bone of the upper arm.

Objectives of the Study

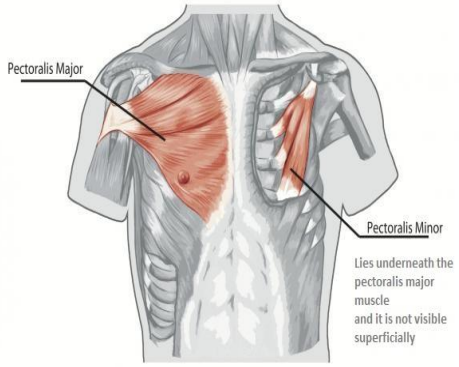
- To find out the muscular involvement of chest & back muscles during executing the jump tennis service in Volleyball.
- To find out the relationship between muscle activity of chest & back and performance of jump tennis service in Volleyball.

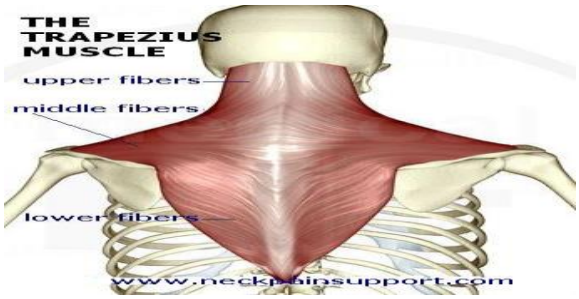
RESEARCH METHODOLOGY

Coverage/ Selection of Subjects

- Universe of the Study: The study was confined to India only.
- Sampling Frame: Subjects were selected as a sampling frame from India only and their age was ranging from 16 to 28 years.
- Sampling Methods: Subjects were selected on the basis of purposively random sampling method.
- Sampling Size: A total of 12 male professional Volleyball players from India were selected for the study.

Units of Observation: Observations were made on the following Variables/contents. Pectoralis Major (PMJ) & Trapezius (TP).





Criterion Measures

Muscles activities during jump tennis service in volleyball were measured by Neuro Trac Myo plus 4. The data was recorded in micro volt (µv).

Collection of Data

The primary/first hand data was collected from 12 male professional Volleyball players in India. The above mentioned tools and techniques for collection of various categories of proposed data were used.

The data for the selected muscles was obtained with the help of the instrument Neuro Trac Myo Plus 4 operated by the investigator at the performance of jump tennis service test. Before the actual testing, the subjects were given a complete demonstration of each test and the purpose of the tests was explained in detail to them. After the demonstration and explanation, electrode points were marked in the presence of specialized persons and physiotherapist, and then subjects were allowed to take practice trials in order to get familiar

with the test. The data was collected only for jump tennis service performance in the court.

After making all entries of the subject pertaining to his profile on the software, the subject performed the skill and their readings were recorded in microvolt (μv).

Statistical Techniques

- The concerned data was analyzed by using descriptive statistical in order to electromyography analyses of chest & back function during executing the jump tennis service in volleyball.
- In order to determine the relationship of selected (Chest & Back) muscles activities with the performance of jump tennis service in volleyball, Pearson Multiple Correlation Technique was used.
- The data was analyzed by using SPSS (Statistical Package for the Social Sciences) version 19. The level of significance for the entire analysis was set at the 0.05 level.

RESULT AND DISCUSSION

Table-1: Descriptive Statistics of the Muscular Contraction of Selected Muscles

		Pectoralis	Trapezius
N	Valid	12	12
	Missing	0	0
Mean		80.4833	135.9917
Std. Error of Mean		6.53543	13.27810
Median		82.9000	121.8000
Mode		47.20[a]	87.30[a]
Std. Deviation		22.63938	45.99669
Variance		512.542	2115.695
Skewness		.422	.942
Std. Error of Skewness		.637	.637
Kurtosis		-.305	-.166
Std. Error of Kurtosis		1.232	1.232
Range		76.10	134.50
Minimum		47.20	87.30
Maximum		123.30	221.80

The table 1 reveals that the muscular contraction of selected muscles during tennis jump tennis service in Volleyball, the mean and standard deviation of upper arm group of muscles were following: Trapezius muscle have highest activation with Mean & SD value of (135.9917) and (45.99669) Pectoralis muscle have 5th highest level activation with Mean & SD (80.4833) and (22.63938) respectively.

Table-2: Relationship of Muscular Contraction of Selected Muscles with the Performance of the Jump Tennis Service in Volleyball Pearson Correlation (Multiple)

		Performance	Pectoralis	Trapezius	Biceps	Triceps	Anterior Deltoid	Posterior Deltoid
Pearson Correlation (Multiple)	Performance	1.000	.573*	-.031	.222	-.011	.377	.144
	Pectoralis	.573*	1.000	-.030	.370	.182	.175	-.145
	Trapezius	-.031	-.030	1.000	-.025	.386	-.056	.462
	Biceps	.222	.370	-.025	1.000	.551	.299	-.087
	Triceps	-.011	.182	.386	.551	1.000	.373	.179
	Anterior Deltoid	.377	.175	-.056	.299	.373	1.000	-.216
	Posterior Deltoid	.144	-.145	.462	-.087	.179	-.216	1.000

*Correlation is significant at the 0.05 level (1-tailed)

Significant value of the correlation coefficient at 0.05 levels with 10 degree of freedom (1-tailed) is 0.497

As shown in table 2, only one muscles group that is Pectoralis is found correlated with the performance of jump tennis service in Volleyball where calculated 'r'(0.573) is found greater than the required tabulated value of 0.497 at 0.05 level of significance. However, the obtain value of Coefficient of correlation

in other variable was less than the required tabulated value at selected level of significance, therefore back muscles (Trapezius) have shown insignificant relationship with the performance of subjects in respect to jump tennis service in Volleyball.

DISCUSSION OF FINDINGS

Trapezius muscle showed the highest activation level of EMG during execution of tennis servive in Volleyball. This higher muscular activity is occurred due to the forcefully right arm movement, when executing the tennis service in Volleyball.

Pectoralis muscles showed the 5th highest activation level of EMG during execution of tennis service in Volleyball. Pectoral muscles (colloquially referred to as "pecs") are the muscles that connect the front of the human chest with the bones of the upper arm and shoulder.

CONCLUSIONS

On the basis of results obtained, following conclusions were drawn:

- According to finding the study, Trapezius muscle showed the highest activation level of EMG during execution of jump tennis servive in Volleyball.
- Pectoralis muscles showed the 5th highest activation level of EMG during execution of jump tennis service in Volleyball.
- Only one muscles group that is Pectoralis is found correlated with the performance of jump tennis service in Volleyball.
- The insignificant relationship was found between back (Trapezius) muscles and with the performance of jump tennis service in Volleyball.

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