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

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Abstract

The Purpose of the study was to EMG Analysis of Deltoid 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: Anterior Deltoid (AD)**,** Middle Deltoid (MD)**,** Posterior Deltoid (PD). **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 deltoid muscles group during executing the jump tennis service in volleyball. In order to determine the relationship of selected (Deltoid) 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:** Anterior Deltoid & Posterior Deltoid muscles showed the 2nd & 3rd highest activation level of EMG during execution of jump tennis service in Volleyball. Insignificant relationship was found between Anterior & Posterior Deltoid muscles group and with the performance of jump tennis service in Volleyball excepting the Pectoralis.

Key Words: **Electromyographic Analysis, Deltoid Muscles & Jump Tennis Service in Volleyball**

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. (Rafael F. Escamilla & James R. Andrews, 2009).

In human anatomy, the deltoid muscle is the muscle forming the rounded contour of the shoulder. Anatomically, it appears to be made up of three distinct sets of fibers though electromyography suggests that it consists of at least seven groups that can be independently coordinated by the nervous system.[1]

It was previously called the deltoideus (plural deltoidei) and the name is still used by some anatomists. It is called so because it is in the shape of the Greek capital letter delta (Δ). It is also known as the common shoulder muscle, particularly in other animals such as the domestic cat. Deltoid is also further shortened in slang as "delt".

An important function of the deltoid in humans is preventing the dislocation of the humeral head when a person carries heavy loads. The function of abduction also means that it would help keep carried objects a safer distance away from the thighs to avoid hitting them, as during a farmer's walk. It also ensures a precise and rapid movement of the glenohumeral joint needed for hand and arm manipulation.[2] The lateral fibers are in the most efficient position to perform this role, though like basic abduction movements (such as lateral raise) it is assisted by simultaneous co-contraction of anterior/posterior fibers.[22]

Objectives of the Study:

1. To find out the muscular involvement of Deltoid muscles during executing the jump tennis service in Volleyball.
2. To find out the relationship between muscle activity of Deltoid group and performance of jump tennis service in Volleyball.

RESEARCH METHODOLOGY

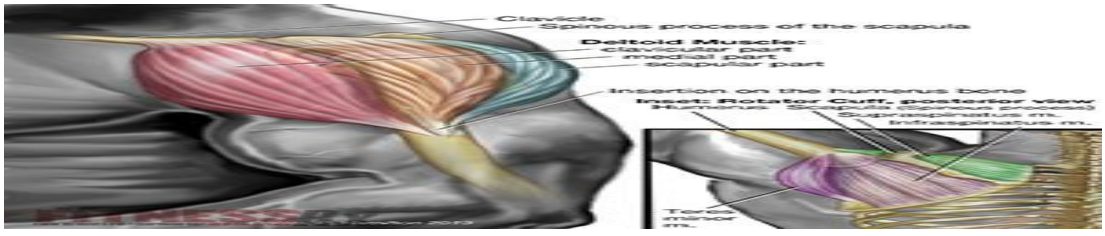
Coverage/ Selection of Subjects

1. Universe of the Study: The study was confined to India only.
2. Sampling Frame: Subjects were selected as a sampling frame from India only and their age was ranging from 16 to 28 years.
3. Sampling Methods: Subjects were selected on the basis of purposively random sampling method.
4. 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.

Anterior Deltoid (AD)**,** Middle Deltoid (MD)**,** Posterior Deltoid (PD)



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 electromyographic analyses of deltoid muscles group during executing the jump tennis service in volleyball.
- In order to determine the relationship of selected (Deltoid) 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

		Anterior Deltoid	Posterior Deltoid
N	Valid	12	12
	Missing	0	0
Mean		132.2250	100.6917
Std. Error of Mean		13.69174	8.62316
Median		121.5000	96.7000
Mode		81.30[a]	68.70[a]
Std. Deviation		47.42957	29.87150
Variance		2249.564	892.306
Skewness		.873	1.274
Std. Error of Skewness		.637	.637
Kurtosis		-.213	1.631
Std. Error of Kurtosis		1.232	1.232
Range		144.20	101.90
Minimum		81.30	68.70
Maximum		225.50	170.60

The table 1 reveals that the muscular contraction of selected muscles during tennis jump tennis service in Volleyball, the mean and standard deviation of deltoid group of muscles were following: Anterior Deltoid muscle have 2nd highest activation with Mean &

SD value of (132.2250) and (47.42957) Posterior Deltoid muscle have 3rd highest activation level with Mean & SD (100.6917) and (29.87150) 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 level with 10 degree of freedom (1-tailed) is 0.497

As shown in table 2, Anterior & Posterior Deltoid muscles group have shown insignificant relationship with the performance of subjects in respect to jump tennis service in Volleyball. Where calculated 'r' values of (.377 & .144) are found less than the required tabulated value of 0.497 at 0.05 level of significance.

Discussion of Findings

Anterior Deltoid & Posterior Deltoid muscles showed the 2nd & 3rd highest activation level of EMG after Trapezius muscles during execution of jump tennis service in Volleyball. The deltoid muscle is the prime mover of arm abduction along the frontal plane. The arm must be medially rotated for the deltoid to have maximum effect. This makes the deltoid an antagonist muscle of pectoralis major and lattissimus dorsi during arm adduction.

The anterior deltoid is weak in strict transverse flexion but assist the pectoralis major during shoulder transverse flexion/ shoulder flexion, when serve is executed due to this anterior deltoid shows 2nd highest activity during the execution or acceleration phase.

Posterior deltoid has also showed 3rd highest activation level of EMG. Execution or acceleration begins with internal rotation of the shoulder and continues until ball impact. Rapid, forceful internal rotation and adduction of the shoulder with forward trunk flexion and elbow extension are the prominent muscular activity but the posterior or rear side of the deltoid mostly involved in extension, transverse abduction and external rotation but strongly involved in transverse extension. The posterior deltoid is also the primary shoulder hyper extensor muscle, more so than the long head of the triceps brachii which also assists in this function. Because of this the posterior deltoid showed 3rd highest level of activation in execution of tennis serve.

The insignificant relationship was found between Anterior & Posterior Deltoid muscles group and with the performance of jump tennis service in Volleyball excepting the Pectoralis.

Conclusions:

On the basis of results obtained and discussion were made on findings, following conclusions were drawn:

1. Anterior Deltoid & Posterior Deltoid muscles showed the 2nd & 3rd highest activation level of EMG during execution of jump tennis service in Volleyball.
2. Insignificant relationship was found between Anterior & Posterior Deltoid muscles group and with the performance of jump tennis service in Volleyball excepting the Pectoralis.

References:

1. Brown JM, Wickham JB, McAndrew DJ, Huang XF. (2007). Muscles within muscles: Coordination of 19 muscle segments within three shoulder muscles during isometric motor tasks. J Electromyogr Kinesiol. 17(1):57-73. PMID 16458022 (https://www.ncbi.nlm.nih.gov/pubmed/16458022) doi:10.1016/j.jelekin.2005.10.007 (https://dx.doi.org/10.1016%2Fj.jelekin.2005.10.007)
2. Potau JM, Bardina X, Ciurana N, Camprubí D. Pastor JF, de Paz F. Barbosa M. (2009). Quantitative Analysis of the Deltoid and Rotator Cuff Muscles in Humans and Great Apes. Int J Primatol 30:697–708. doi:10.1007/s10764-009-9368-8 (https://dx.doi.org/10.1007%2Fs10764-009-9368-8)
3. The Anatomy of the Shoulder Muscles (http://www.fitstep.com/Advanced/Anatomy/Shoulders.htm): "The Deltoid is a three-headed muscle that caps the shoulder. The three heads of the Deltoid are the Anterior, Lateral, and Posterior."
4. "Deltoid Muscle" (http://www.wheelessonline.com/ortho/deltoid_muscle). Wheeless' Textbook of Orthopaedics. December 2011. Retrieved January 2012. Check date values in: |access-date= (help)
5. Leijnse, J N A L; Han, S-H; Kwon, Y H (December 2008). "Morphology of deltoid origin and end tendons – a generic model" (http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2666142/pdf/joa0213-0733.pdf?tool=pmcentrez) (PDF). *J Anat*. 213 (6): 733–742. doi:10.1111/j.1469-7580.2008.01000.x (https://doi.org/10.1111%2Fj.1469-7580.2008.01000.x). PMC 2666142 (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2666142) . PMID 19094189 (https://www.ncbi.nlm.nih.gov/pubmed/19094189). Retrieved January 2012. Check date values in:|access-date= (help)
6. Anterior Deltoid (http://www.exrx.net/Muscles/DeltoidAnterior.html)
7. Pick up your delts (http://www.muscleandfitness.com/training/arms/pick-your-delts) from Muscle and Fitness: "target point: front/middle delts"
8. Lateral deltoid (http://www.exrx.net/Muscles/DeltoidLateral.html)
9. The Best Exercise for Outer Delts (http://www.livestrong.com/article/530154-the-best-exercise-for-outer-delts/) on LiveStrong.com in 2011
10. Shoulders Anatomy (http://www.abcbodybuilding.com/anatomy/shouldersanatomy1.htm) by Yu Yevon
11. Posterior Deltoid (http://www.exrx.net/Muscles/DeltoidPosterior.html)
12. Rear Deltoid Stretch (http://www.exrx.net/Stretches/DeltoidPosterior/RearDelt.html)
13. Lee Hayward - Rear delts (http://www.leehayward.com/rear_delts.htm)

14. Fick, R. (1911). *Handbuch der Anatomie und Mekanik der Gelenke*. Jena: Gustav Fischer.
15. Kapandji, Ibrahim Adalbert (1982). *The Physiology of the Joints: Volume One Upper Limb* (5th ed.). New York: Churchill Livingstone.
16. Rispoli, Damian M.; Athwal, George S.; Sperling, John W.; Cofield, Robert H. (2009). "The anatomy of the deltoid insertion" (https://web.archive.org/web/20120904122301/http://www.anatomytrains.com/uploads/rich_media/Rispoli2009_anatomyDeltoidInsertion.pdf) (PDF). *J Shoulder Elbow Surg*. 18: 386–390. doi:10.1016/j.jse.2008.10.012 (https://doi.org/10.1016%2Fj.jse.2008.10.012). Archived from the Original (http://www.anatomytrains.com/uploads/rich_media/Rispoli2009_anatomyDeltoidInsertion.pdf) (PDF) on 2012-09-04.
17. Anatomy photo:03:03-0103 (http://ect.downstate.edu/courseware/haonline/labs/l03/030103.htm) at the SUNY Downstate Medical Center
18. Radiography of the Upper Extremities: 24 ARRT Category A. CE4RT, 2014. 201. Print.
19. *Muscles/DeltoidAnterior at exrx.net (http://www.exrx.net/Muscles/DeltoidAnterior.html)*
20. *Muscles/DeltoidLateral at exrx.net (http://www.exrx.net/Muscles/DeltoidLateral.html)*
21. *Muscles/DeltoidPosterior at exrx.net (http://www.exrx.net/Muscles/DeltoidPosterior.html)*
22. http://muscleguide.co.uk/exercises/lateral-deltoid-raise.html