Comparison of Duration from Muscle Activation Time to Ball Release between Successful and Unsuccessful Free Shots in Basketball

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Abstract

The study aimed at comparing the electromyographical variable (duration from muscle activation time to ball release) responsible for a successful and unsuccessful free shot in basketball. Five subjects of homogenous nature in terms of anthropometric measurements and training age were selected. Human Karigar Nexus-10 channel Physiological Monitoring and Feedback System was used for recording the muscle outputs. Paired 't' test was employed to check the significance of the differences. Significant difference was found ECR, FCR, Biceps brachii. This leads to the conclusion that duration from muscle activation time to ball release is a significant factor for successful free shots in basketball in respect to ECR, FCR, and Biceps brachii.

KEYWORDS: Basketball, Free shot, electromyography, Analysis

INTRODUCTION

Shooting is the principal method used to score points in Basketball and for this reason it is the most frequently used technical action (hay 1994). The free throw shot is distinguished as the most important of all the shooting actions (Hess 1980).efficacy in shooting is identified with the ability to perform well in this sport and consequently it is extensively practiced.

The free throw is the single most important shot in the game of Basketball, a close to 20% of all points in NCAA division. The shot becomes more important later in the game, as the free throws comprise a significant greater percentage of the total points scored during the last 5 minutes than the first 35 minutes of the game for both the winning and losing team (Kazan et al, 1994).

The free throw should be one of the easiest shots in Basketball (Okubo & Hubbard, 2006), since the player is all alone, 15 feet from the basket, with no defence and no close distractions, all the player has to do is to get ready, aim, cock the ball and shoot.

The majority of coaches identify shooting as the most important skill of Basketball. It doesn't deny the importance of other skills- dribbling, passing or foot work- but only assumes that all offensive actions end in shooting. With this level of significance in the game, all fundamentals in the teaching methodology of shooting should be assured by the coaches. Usually it's based on permanent adjustment of theoretical sentences of performance and individual characteristics of the players. Shooting is the first technical content of Basketball that youngsters want to learn. The youngster's feeling of success in the game result from the efficacy of shooting performance (Krausse, 1984). The quality of the shooting learning process is very important in the development of young players. Such a process must be conducted by coaches with care and knowledge. It is reasonable to accept the theory that, "shooters are not born but made" (Newell & Benington, 1962).

Biomechanics is most useful in improving performance in sports or activities where technique is the dominant factor rather than physical structure or physiological capacity. One of the major problems in this field is the measurement of what one might call good body mechanics, objectively, without undue dependence upon inconsistent subjective judgments. Electromyography is the recording of the electrical activity of the muscles, and therefore constitutes an extension of the physical exploration and testing of the integrity of the motor system Electromyography is the tool that can be very valuable in measuring skeletal muscles electric output during physical activities. It is important that the EMG is detected correctly and interpreted in light of basic biomedical signal processing, and physiological and biomechanical principles (Soderberg, 1992).. Thus the current study intended to compare the muscle activation time to ball release between the phases of successful and unsuccessful free shots.

METHODS

Subjects

Five right handed male university level basketball players with an age range from 18 to 23 years having same playing experience were selected for this study. Purposive sampling was used to select the sample. All the subject were with equal arm length and almost equal height (180cm± 1 cm) without any anatomical deformity and also free from any orthopaedic or neurological disorders.

Variables

Based on literary evidence, correspondence with the expert and scholar's own understanding and keeping the feasibility criterion in mind, average rectified EMG reading was selected.

Instruments

For analyzing the muscles activities apparatus used for surface EMG recording was Human Karigar Nexus-10 channel Physiological Monitoring and Feedback System, India.

EMG Protocol and Analysis

EMG signals were amplified by Driver Microsoft window 7, (input impedance =100 milliohm A/D converter with ±5V input range). Following settings were used: bandwidth =20-500 Hz, input impedance >100mΩ, Common Mode Rejection Ratio > 80 dB, maximum input voltage = ±5V, sampling rate =2048 sample per second.

i. **EMG Operating:-**

The start and end of both data collection were controlled by the experimenter using a switch connected to both data loggers. Care was taken that no tension was developed in the connecting wires.

ii. EMG Normalizing Procedure:

Before the throws trials, EMG data of selected muscles were collected during maximal voluntary isometric contractions (MVIC) in order to normalize the EMG data during the shot. Subjects were asked to perform MVIC for each concerned muscle as described by (Daniels and Worthingham's, 2003).

iii. Skin Preparation and Electrodes Placement:-

Each subject's skin was prepared for EMG electrode placement by shaving, abrading the skin with fine emery paper and then cleaning the area thoroughly with an alcohol swab. Pairs of Ag-AgCl surface EMG electrodes (8 mm active diameter) were attached to the skin. The inter electrode distance was kept constant at 20 mm apart along the expected muscle fibre. Electrodes were placed on the midline of muscles belly, between the myotendinous junction and the nearest innervations zone, with the detection surface oriented perpendicularly to the length of muscle fibre. Electrical stimulation or surface electrical mapping was used to locate the innervations zone.

Fig 1: Electrode Placement

FINDINGS

Table-1

COMPARISON OF DURATION FROM MUSCLE ACTIVATION TIME TO BALL RELESE BETWEEN SUCCESSFUL AND UNSUCCESSFUL SHOTS

Muscles	Shots	Mean	SD	SEM	t-Value	df	p-Value
Anterior Deltoid	Successful	0.20	0.01	0.004	1.384	28	.177
	Unsuccessful	0.19	0.01	0.004			
Posterior Deltoid	Successful	0.16	0.01	0.003	.902	28	.375
	Unsuccessful	0.15	0.02	0.004			
Biceps Brachii	Successful	0.13	0.01	0.003	1.843	28	.076
	Unsuccessful	0.12	0.01	0.003			
Triceps Brachii	Successful	0.22	0.03	0.007	2.777	28	.010*
	Unsuccessful	0.20	0.02	0.004			
FCR	Successful	0.16	0.01	0.003	2.197	28	.036*

	Unsuccessful	0.15	0.01	0.003			
ECR	Successful	0.26	0.01	0.003	4.378	28	.000*
	Unsuccessful	0.24	0.01	0.004			

*p-value < 0.05

The mean, standard deviation and standard error of mean of anterior deltoid (duration from muscle activation time to ball release) of successful shots were 0.20, 0.01 and 0.004 respectively and of unsuccessful shots were 0.19, 0.01 and 0.004 respectively. As the calculated t-ratio of anterior deltoid muscle between successful and unsuccessful shot is 1.384, which is not significant (table value 2.048 at df 28), it can be concluded that there is no significant difference present in this variable between successful and unsuccessful shots.

The mean, standard deviation and standard error of mean of Posterior deltoid (duration from muscle activation time to ball release) of successful shots were 0.16, 0.01 and 0.003 respectively and of unsuccessful shots were 0.15, 0.02 and 0.004 respectively. As the calculated t-ratio of Posterior deltoid muscle between successful and unsuccessful shot is 0.92, which is not significant (table value 2.048 at df 28), it can be concluded that there is no significant difference present in this variable between successful and unsuccessful shots.

The mean, standard deviation and standard error of mean of Biceps Brachii deltoid (duration from muscle activation time to ball release) of successful shots were 0.13, 0.01 and 0.003 respectively and of unsuccessful shots were 0.12, 0.01 and 0.003 respectively. As the calculated t-ratio of Biceps Brachii muscle between successful and unsuccessful shot is 1.843, which is not significant (table value 2.048 at df 28), it can be concluded that there is no significant difference present in this variable between successful and unsuccessful shots.

The mean, standard deviation and standard error of mean of Triceps Brachii (duration from muscle activation time to ball release) of successful shots were 0.22, 0.03 and 0.007 respectively and of unsuccessful shots were 0.20, 0.02 and 0.004 respectively. As the calculated t-ratio of Triceps Brachii muscle between successful and unsuccessful shot is 2.777, which is significant (table value 2.048 at df 28), it can be concluded that there is significant difference present in this variable between successful and unsuccessful shots.

The mean, standard deviation and standard error of mean of FCR (duration from muscle activation time to ball release) of successful shots were 0.16, 0.01 and 0.003 respectively and of unsuccessful shots were 0.15, 0.01 and 0.003 respectively. As the calculated t-ratio of FCR muscle between successful and unsuccessful shot is 2.197, which is significant (table value 2.048 at df 28), it can be concluded that there is significant difference present in this variable between successful and unsuccessful shots.

The mean, standard deviation and standard error of mean of ECR (duration from muscle activation time to ball release) of successful shots were 0.26, 0.01 and 0.003 respectively and of unsuccessful shots were 0.24, 0.01 and 0.004 respectively. As the calculated t-ratio of ECR muscle between successful and unsuccessful shot is 4.378, which is significant (table value 2.048 at df 28), it can be concluded that there is significant difference present in this variable between successful and unsuccessful shots.

Comparison of duration from muscle activation time to ball release between successful and unsuccessful shots is graphically presented below in fig.2.

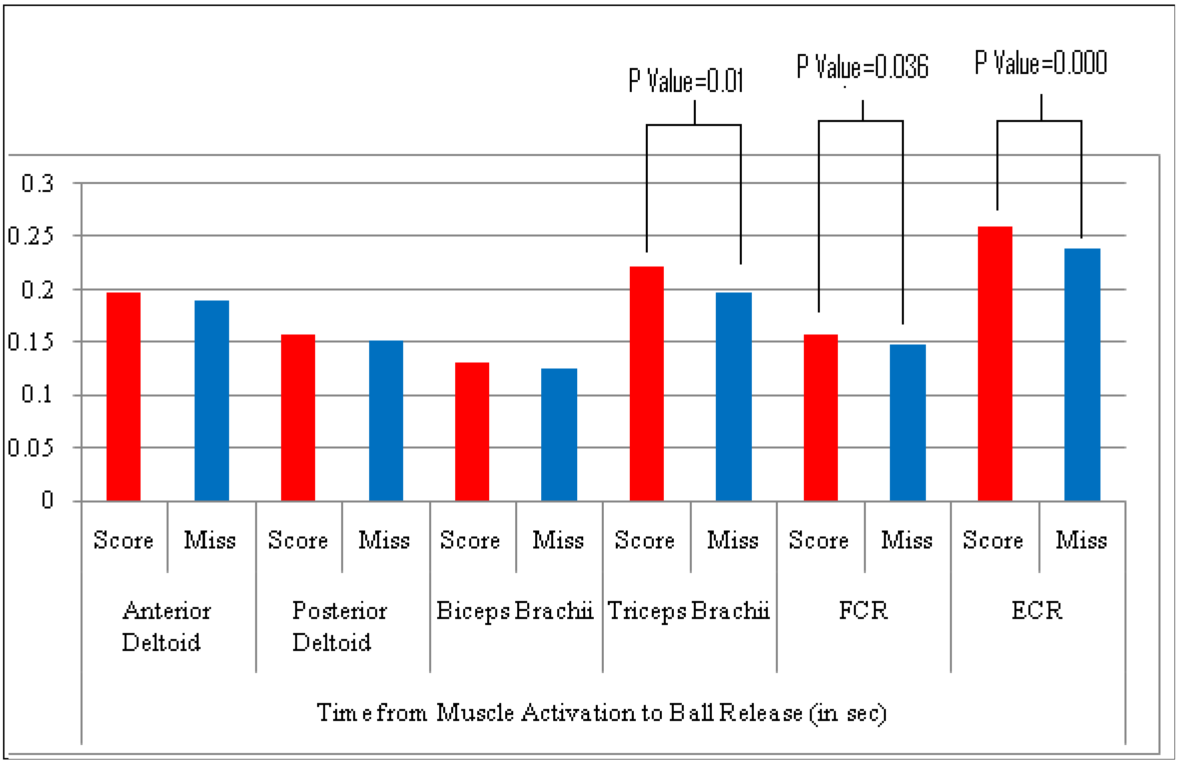

Fig.2: Comparison of Duration from Muscle Activation Time to Ball Release between Successful and Unsuccessful Shots

DISCUSSION

It shows that there was no significant difference between successful and unsuccessful shot in anterior deltoid, posterior deltoid and biceps brachii and there was a significant difference between successful and unsuccessful shot in triceps brachii, FCR and ECR, as activation of triceps brachii, ECR and FCR muscles is due to the effect of arm straightening, starting from elbow joint to wrist joint. In contrast with contraction duration, successful shot tended to have the larger mean values, indicating earlier activation. Triceps brachii, FCR and ECR get activated for longer time, as these muscles had to produce more action potential for the release of ball during the time of propulsion phase. Shooting arm is always closer to motion direction, during the ball lifting over the head, as well as straightening of arms in elbow joint. Stuart (1999) also confirms this finding in his study conducted to analyse EMG of selected muscles during shots and passes in basketball.

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