Comparison of Average Rectified Emg Between Successful and Unsuccessful Free Shots in Basketball

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Abstract

The study aimed at comparing the electromyographical variable (Average rectified time) 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. No significant difference was found in any of the phases of throwing of successful shots to that of unsuccessful shots. This leads to the conclusion that average rectified EMG is not a significant factor for successful free shots in basketball.

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 average rectified EMG between 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 AVERAGE RECTIFIED EMG BETWEEN SUCCESSFUL AND UNSUCCESSFUL SHOTS

Muscles	Shots	Mean	SD	SEM	t-Value	df	p-Value
Anterior Deltoid	Successful	61.61	2.74	0.71			
	Unsuccessful	62.97	5.07	1.31	0.43	28.00	0.67
Posterior Deltoid	Successful	41.12	2.82	0.73			
	Unsuccessful	41.46	2.62	0.68	0.23	28.00	0.82
Biceps Brachii	Successful	40.09	5.20	1.34			
	Unsuccessful	40.96	4.81	1.24	0.62	28.00	0.54
Triceps Brachii	Successful	57.24	4.42	1.14			
	Unsuccessful	57.94	10.22	2.64	-0.24	19.07	0.81
FCR	Successful	58.86	2.98	0.77			
	Unsuccessful	59.82	5.86	1.51	1.20	20.76	0.24
ECR	Successful	63.33	4.45	1.15			
	Unsuccessful	57.50	10.56	2.73	1.97	18.83	0.06

Note: df less than 28 are due to the adjustment during Levene's Test for Equality of Variances.

The mean, standard deviation and standard error of mean of anterior deltoid (average rectified EMG) of successful shots were 61.61, 2.74 and 0.71 respectively and of unsuccessful shots were 62.97, 5.07 and 1.31 respectively. As the calculated t-ratio of anterior deltoid muscle between successful and unsuccessful shot is 0.43, 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 (average rectified EMG) of successful shots were 41.12, 2.82 and 0.73 respectively and of unsuccessful shots were 41.46, 2.62 and 0.68 respectively. As the calculated t-ratio of Posterior deltoid muscle between successful and unsuccessful shot is 0.23, 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 (average rectified EMG) of successful shots were 40.09, 5.20 and 1.34 respectively and of unsuccessful shots were 40.96, 4.81 and 1.24 respectively. As the calculated t-ratio of Biceps Brachii muscle between successful and unsuccessful shot is 0.62, 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 (average rectified EMG) of successful shots were 57.24, 4.42 and 1.14 respectively and of unsuccessful shots were 0.29, 0.04 and 0.009 respectively. As the calculated t-ratio of Triceps Brachii muscle between successful and unsuccessful shot is 0.24, which is not significant (table value 2.093 at df 19), 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 FCR (average rectified EMG) of successful shots were 58.86, 2.98 and 0.77 respectively and of unsuccessful shots 59.82, 5.86 and 1.51 respectively. As the calculated t-ratio of FCR muscle between successful and unsuccessful shot is 1.20, which is not significant (table value 2.080 at df 21), it can be concluded there is no significant difference present in this variable between successful and unsuccessful shots.

The mean, standard deviation and standard error of mean of ECR (average rectified EMG) of successful shots were 63.33, 4.45 and 1.15 respectively and of unsuccessful shots were 57.50, 10.56 and 2.73 respectively. As the calculated t-ratio ECR muscle between successful and unsuccessful shot is 1.97, which is not significant (table value 2.093 at df 19), it can be concluded that there is no significant difference present in this variable between successful and unsuccessful shots.

Graphical representation of comparison of average rectified EMG between successful and unsuccessful shots is presented bellow in fig.22.

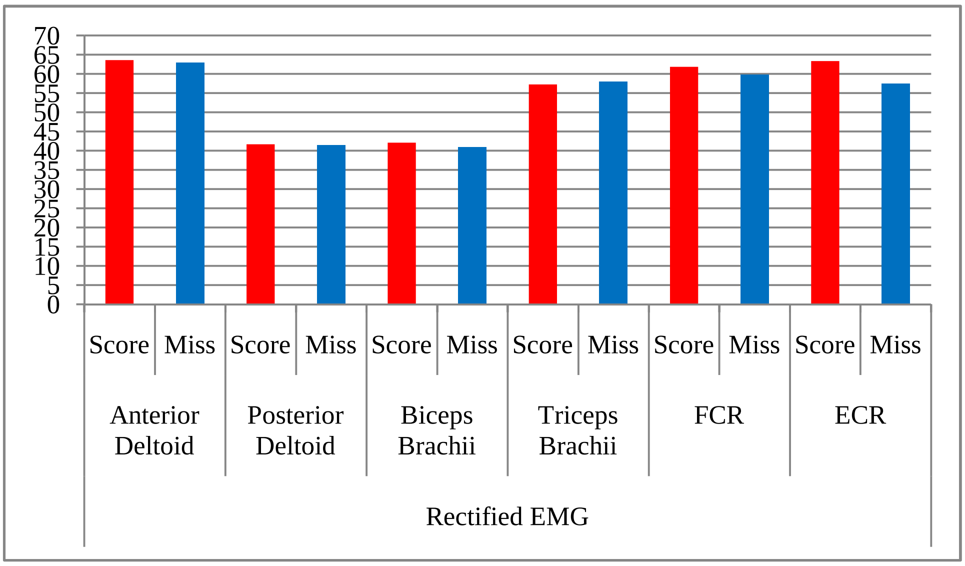

Fig.2: Comparison of Average Rectified EMG between Successful and Unsuccessful Shots

DISCUSSION

There was no significant difference between scores of successful and unsuccessful shot for this variable but variability for unsuccessful shots tended to be greater than for successful shots. Successful shots show smaller average EMG bioelectric activity as compared to unsuccessful shot; this is so as reduced neuromuscular activity is associated with increased movement accuracy and discriminate motor unit recruitment might explain the increase in movement accuracy. Árpadillyes and Rita M. Kiss (2003) have conducted similar study which support the present results of the study. The finding also supports the results obtained in the study conducted by Stuart (1999). The finding is also echoed in the study conducted by Abe s. (2005) in his study aimed at measuring the assessment of skill acquisition. This leads to the conclusion that average rectified EMG is not a significant factor for successful free shots in basketball.

REFERENCE

Alexander RM, “Optimum Timing of Muscle Activation for Simple Models of Throwing” Journal Of Theoretical biology, Volume 150, 1991.

Árpadillyes and Rita M. Kiss, “Shoulder muscle activity during pushing, pulling, elevation and overhead throw” Journal of electromyography and kinesiology, Volume 15, issue 3, 2005.

Árpadillyes and Rita M. Kiss. “Comparative EMG Analysis Of The Shoulder Between Recreational Athletes And Javelin Throwers During Elementary Arm Motions And During Pitching” Physical Education And Sport Vol. 1, issue 10, 2003.

Bryan T. Kelly et.al, “Electromyographic Analysis and Phase Definition of the Overhead Football Throw” The American journal of sports medicine, 2001.

Bartlett. R, “Throwing: Fundamentals and Practical Applications” International Symposium on Biomechanics in Sports, 18, 2000.

Chris Buttona, Morven Macleodb, Ross Sandersb & Simon Colemanb, “Examining Movement Variability in the Basketball Free-Throw Action at Different Skill Levels” Research Quarterly for Exercise and Sport, Volume 74 (3), 2003.

Christensen H and Frederiksen, “Quantitative Surface EMG during Sustained and Intermittent Submaximal Contractions” Electroencephalograms Clinical Neurophysiology, Volume 70, 1988.

David R, Mullineaux & Timothy L, “Coordination-variability and kinematics of misses versus swishes of Basketball free throws” Journal of Sports Sciences, Volume28 (9), 2010.

Denise Derbyshire, “Physical factors influencing the throwing action in netball and cricket players” Stellenbosch University, 2007.

Escamilla RF, Speer KP, Fleisig GS, Barrentine SW and Andrews JR, “Effects Of Throwing Overweight And Underweight Baseballs On Throwing Velocity And Accuracy” Sports Medicine, Volume 29, 2000.

F. J. Rojas, M. Ceprero, A. Ona and M. Gutirrez, “Kinematic adjustment in the Basketball jump shot against an opponent” Ergonomics, Volume 43, Issue 10, 2000.

Gowan ID, Jobe FW, Tibone JE, Perry J, Moynes DR. “A Comparative Electromyographic analysis of the Shoulder during Pitching: Professional versus Amateur Pitchers” American Journal of Sports Medicine, Volume15 (6), 1987.

Gordon R. Hamilton & Christoph Reinschmidt, “Optimal trajectory for the basketball free throw” Journal of Sports Sciences, Volume 15, issue5, 1997.

Hof AL, Pronk CN & van Best JA “Comparison between EMG to force processing and kinetic analysis for the calf muscle moment in walking and stepping” Journal of Biomechanics, Volume 20, issue2, 1987.

Hoffman, Shirl J, Imwold, Charles H and Koller, John A, “Accuracy and prediction in throwing in between male and female children “Research quarterly for exercise and sports, Volume 54, issue 1, 1983.

Hore J, Watts S, Tweed D, Et Al. “Over arm Throws with the No dominant Arm: Kinematics Of Accuracy” J Neurophysiology, Volume 76, issue 6, 1996.

Hug F, Laplaud D, Lucia A, &Grelot L “EMG Threshold Determination In Eight Lower Limb Muscles During Cycling Exercise: A Pilot Study” International Journal Of Sports Medicine, Volume 27, issue 6, 2006.

H. Okuboa & M. Hubbardb, “Dynamics of the basketball shot with application to the free throw” Journal of Sports Sciences, Volume 24(12), 2006.

Ioannis, B, Giorgos, G, And Konstantinos, B, “Accuracy and Throwing Velocity In Handball”, International Symposium On Biomechanics In Sports, 1998.

Istvan karacsony and Ivan Cuk, “Pommel Horse: Exercise Methods, Idea, Curiosities, History” (Ljublijana: faculty of Sports, University), 1998.

Ikram Hussain and Mohd. Arshad “Biomechanical analysis of cricket ball throwing techniques” Journal of Education and Practice, Vol. 2, issue 3, 2011.

Jobe FW, Tibone JE, Perry J and Moynes, “An EMG Analysis of the Shoulder in Throwing and Pitching: A Preliminary Report” American Journal of Sports Medicine, Vol. 11, 1983.

Jackie L. Hudsona, “Prediction of Basketball Skill Using Biomechanical Variables” Research Quarterly for Exercise and Sport, Volume 56(2), 1985.

Juan Antonio Garcíaa, Rafael Sabidob, David Barbadob &Francisco Javier Morenob, “Analysis of the relation between throwing speed and throwing accuracy in team-handball according to instruction” European Journal of Sport Science, Volume 13, Issue 2, 2013.

Jaspal S. Sandhu, S.M and Shweta S “An Electromyographic Analysis of Shoulder muscle activation during push-up variations on stable and labile surfaces” International Journal Of Shoulder Surgery, Vol. 2, 2008.

J. Hore, S. Watts, D. Tweed, and B. Miller, “Over arm throws with the no dominant arm: kinematics of accuracy” Journal of Neurophysiology, Volume 76, 1996.

Laurie A. Malone, Pierre L. Gervais, Robert D. Steadward, ”Shooting mechanics related to player classification and free throw success in wheelchair basketball” Journal of Rehabilitation Research and Development, Vol. 39 (6), 2002.

Masaya Hirashima et.al. “Sequential muscle activity and its functional role in the upper extremity and trunk during overarm throwing” Journal of Sports Science, Volume 20, 2002.

Moynes D.et.al, “An EMG analysis of the shoulder in throwing and pitching: A preliminary report”, American Journal of Sports Medicine, Volume 11, issue1, 1983.

Marie A. Dupuya, Denis Mottetb & Hubert Ripollc, “The regulation of release parameters in underarm precision throwing” Journal of sports sciences, Volume 18, issue 6, 2006,

Nissan, K. et. Al, “EMG signal analysis for identifying walking patterns of normal healthy individuals” Indian Journal of Biomechanics, 2009.

Roland T and Gertjan E. "Force-Velocity relationship and Coordination in over arm throwing" Journal of Sports Science and Medicine, Volume 3, 2004.

Saleh A. Al-Abood, Simon J. Bennett, Francisco Moreno Hernandez, Derek Ashford & Keith Davids, "Effect of verbal instructions and image size on visual search strategies in basketball free throw shooting" Journal of Sports Sciences, Volume 20 (3), 2002.

Schmidt A, "Movement pattern recognition in basketball free-throw shooting" Human Movement Sciences, Volume31 (2), 2012.

Tran, CM & Silverberg, LM, "Optimal release conditions for the free throw in men's basketball" Journal of Sports Sciences., Volume 26(11), 2008.

Van Den Tillaar R, And Ettema G, "Instructions Emphasizing Velocity, Accuracy, Or Both In Performance And Kinematics Of Overarm Throwing By Experienced Team Handball Players" Perceptual & Motor Skills Percept Mot Skills, Vol. 97, 2003.

Z. Ning, A. Faro, D. Sue and N. Hamilton. "Kinesiological Analysis of Over arm Throwing for Accuracy with Dominant and Non-Dominant Arms" International Symposium on Biomechanics in Sports, 1999.