A Comparative Study of Amount of Electrical Activity of Musculus Rectus Abdominis and Quadriceps at Abdomen Training from Different Mechanical Positions

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Abstract

Currently, athletes and non-athletes are suffering from exerting double efforts with time which is supposed to lessen this effort because of other training applied in order to enhance other muscles separately which gives more benefits especially for the legs. This is one of the problems which sometimes lead to dangerous injuries especially for athletes who do not know the importance of choosing the optimal training position. The importance of this study lies in highlighting the load resulted from abdomen training with two different positions with contribution of some muscles through studying electricity and some variables of neural signal preparing these muscles to determine the best position which do not lead to put physical load or load on the spine or its vertebrae.

The empirical method was used and the sample of the study was chosen purposively (8 body building players of Faculty of Physical Education – Thi Qar University). Players performed abdomen and legs training in extending and bending positions. The most important conclusions of the study are: performing abdomen training with knee bending leads to better targeting towards abdomen muscles which was clear from muscle's electrical activity, more participation of other muscles in positions of abdomen and legs extended, these muscles have special training that has to be applied separately and abdominal training performance from the position of legs extension forms more load on the spine which may result in some problems with time especially for non-athletes.

Keywords: electrical activity, musculus rectus abdominis and quadriceps, abdominal training

1. Introduction

The role of physical education is important to keep health for athletes and non-athletes. It is a duty for specialists in scientific research in physical education to offer everything that enhances performance and not exposing male or female athletes to any kind of injury or overloads. Saving effort is one of the easy methods that benefit in developing fitness in general and it is the duty of biomechanics specialists to tackle these problems accompanying athletic work in terms of physical, skill training or determining which means are the most suitable for physical or skill performance in order to benefit better without facing problems or wasting exerted effort.

Isolation in training parts is sometimes important in the form of not contributing a great number of muscles in training as long as there is another training working directly on these contributing parts as in abdominal training as its main purpose is to develop abdominal muscles' abilities. However, leg muscles interfere accidentally in this work. Back muscles also play a role due to the formation of human body and its parts mechanism. It is like an open kinematical series containing joints that play the role of connectors and muscles play the role of a kinematic power of these connectors. There are two different positions for this training which is practiced most by athletes or sportsmen whether with or without appliances. Mostly it is done without appliances as performance intensity increases without the help of appliances.

From previous illustration, it can be said that importance of the study can be determined in highlighting the load resulted from abdomen training with two different positions with contribution of some muscles through studying electricity and some variables of neural signal preparing these muscles to determine the best position which do not lead to put physical load or load on the spine or its vertebrae under direct effect in this work which provides information which helps get rid of wrong use of this position during practicing abdominal training.

Currently, athletes and non-athletes are suffering from exerting double efforts with time which is supposed to lessen this effort because of other training applied in order to enhance other muscles separately which gives more benefits especially for the legs. This is one of the problems which sometimes lead to dangerous injuries especially for athletes who do not know the importance of choosing the optimal training position.

2. Goals of the Study:

- ✓ Identify the amount of electrical activity for both musculus rectus abdominis and quadriceps while performing abdominal training from two different mechanical positions.
- ✓ Comparing electrical activity amount for musculus rectus abdominis and quadriceps while performing abdominal training from two different mechanical positions.
- ✓ There are statistically significant differences in the amount of electrical activity of musculus rectus abdominis and quadriceps while performing abdominal training from two different mechanical positions.

3. Methodology:

The researchers used the descriptive method with comparative studies.

Sample of the Study:

The selection of players practicing abdominal training was because those electrical signals are scattered for beginners or those who did not practice this training, so we will get rid of high electrical signal resulting from not regulating the signal because of participation of different muscular groups affecting the real amount of the signal for abdominal muscles which was asserted by (Komi & Hakkinen, 1998) that: "the increase in muscular strength is not only related to muscular hypertrophy and the real increase in muscular strength happens for people who were not previously trained which resulted in neural kinematic activity for muscles", while (Stoboy & Friedebold, 1968) said that: "muscle training may lead to reduction of spontaneous extension of kinetic units in producing power by muscles which economizes kinetic motivation for extending unit, but this increase in well trained muscles.

The sample of the study was chosen purposively (8 body building players of Faculty of Physical Education – Thi Qar University). Players were chosen from sporting clubs or can be practitioners of this sport with focus on all body muscles including abdominal muscles. The researchers considered harmony of layers in all variables of the study that may affect giving accurate results. Among these variables, there is training age, total weight, total length, legs and trunk length. Coefficient of variation was chosen for consistency of sample elements. If the value of variation coefficient less than 30%, this means that there is this harmony among sample respondents. Table (1) shows values of arithmetic means, standard deviations and variation coefficient for the sample of the study:

Table (1) Arithmetic means, standard deviations and variation coefficient for the sample of the study

Serial	Variables	Mean	S.D	variation coefficient
1	Age (years)	22.25	1.035	4.652
2	Training age (years)	2.125	0.354	16.659
3	Length (cm)	183.375	1.408	0.768
4	Weight (kg)	82.25	4.432	5.388
5	Trunk length (cm)	51.75	3.196	6.176
6	Leg length (cm)	109.25	2.493	2.282
7	Thigh length (cm)	53.5	2.976	5.563
8	Cross section in musculus quadriceps at contraction	56.125	4.224	7.526

Measuring Method:

The EMG device was chosen (model: MYO TRACE) working by Bluetooth signals for a distance of 40 m. it is a small device less than 390 gm to be put near players to send Bluetooth signals about muscle activity to be received by another device connected to personal laptop by Bluetooth signals. The modern EMG allows athletes to perform all types of movements including jumping, rotation and quick running for a distance of 40 m from signal reception location and the signal is saved. The signal represents the start and ending time for muscle activity, capacity of its electricity with operation space for general movement muscles. This was done as follows:

1- The used muscles in the study are determined through frontal view of the body included in the EMG program as this form helps determine locations of the needed muscles programmed in the EMG device.
2- After determining muscles, their locations are shaved of hair and then cleaned by detol solution. This is important to remove the thin layer of skin or dirt that affect electrical signal.
3- Athletes are asked to contract muscle musculus rectus abdominis and front quadriceps to put surface electrodes at the top of muscles during muscle contraction as these electrodes record the amount of electrical signals out of muscles referring to the average of their electrical activity. The closest electrode to the motivating kinetic unit will record higher EMG signal and lower if the unit was far from it. Surface electrodes consist of a small metal plate (Diameter: 1 cm) and it can be smaller in size if we test small muscles. It is made of silver chloride and is highly sensitive to electric signal from muscles close to skin. After that, electrical signals are sent to computer screen to show signal strength and form via a special software program analyzing stored data and giving important reports about muscle activity.
4- The EMG device is consisted of two channels: the first channel consists of three electrodes on musculus rectus quadriceps and the other channel contains two electrodes to be put on musculus rectus abdominis and these electrodes are connected using electric wires of the EMG device.
5- Connect the photography machine (LOGITECH WEBCAM SOFTWARE) to computer after activating the Bluetooth signal and send the image to the EMG software saved in the computer as follows in the figure (1):

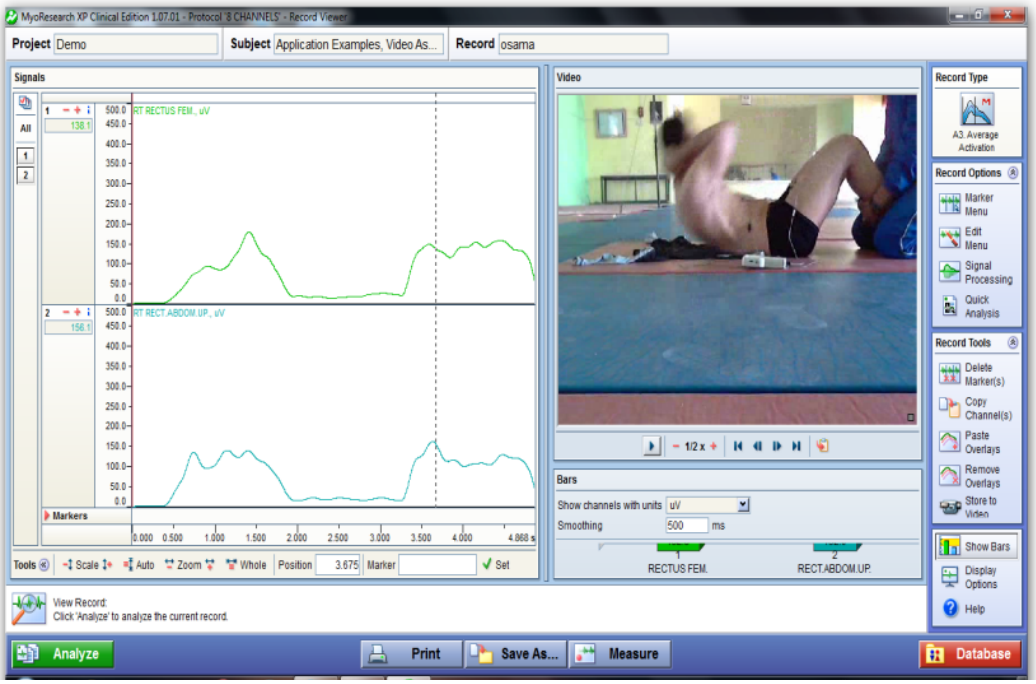

Figure (1): the form of EMG program during sending a Bluetooth signal to the computer

6- After ending training, the path of electric signals will be winding with big refractions to be removed. Elwan, W. says that the EMG signal is a random one in nature because of continuous change in renewing kinetic units which result in not producing similar EMG signals once again. To control thie phenomena, a mathematical process called: (DIGITAL SMOOTHING) is used to determine average signal development direction and then helping us clearly read results. After that, the path of both muscles appears in one field (horizontal axis representing time and measured by the ml/sec, and vertical axis representing signal strength and measured by the michrovolt) as in figure (2):

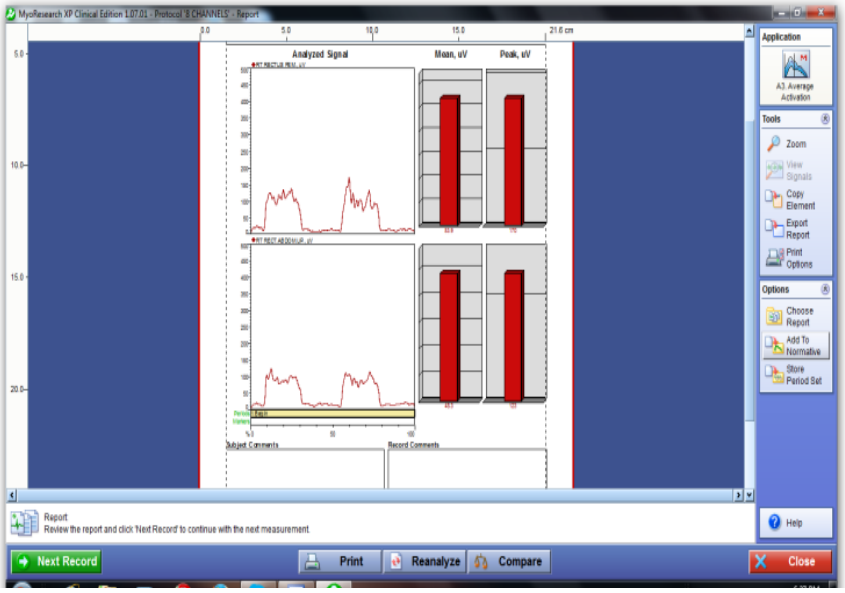

Figure (2): horizontal, vertical axes and signal amount for the Biceps Brachii muscle

4. Discussing Results:

Table (2) arithmetic means and standard deviations of electrical signal amount for musculus rectus abdominis and quadriceps from different positions:

VALUE T.	EXERCISE ABDOMEN AND LEGS OUTSTRETCHED		EXERCISE ABDOMEN AND LEGS BENT		VARIABLES
	STD. DEVIATION	MEAN	STD. DEVIATION	MEAN	
7.27	3.56	117.50	20.04	178.00	PEAK ABDOMINAL MUSCLE
3.17	5.91	165.16	21.28	136.5	PEAK MUSCLE RECTUS FEMORIS
3.38	3.81	48.21	9.36	62.18	MEAN ABDOMINAL MUSCLE
0.94	6.47	52.65	10.17	57.31	MEAN MUSCLE RECTUS FEMORIS
5.86	2.85	97.38	13.89	131.38	RMS ABDOMINAL MUSCLE
1.65	0.19	120.73	15.10	110.51	RMS MUSCLE RECTUS FEMORIS

The previous table shows that there is a significant difference in the electrical value of the curve for abdominal muscles while performing training from the two different positions (knee extension and bending) for the sake of bending knees. This means that abdominal muscle activity is bigger when practicing this training with knee bending and this is the hoped goal from performing abdominal training. More focus is put on the operation of this muscle. Accordingly, training will not bring great benefit for developing the abdominal muscle.

Moreover, there is a difference in curve top at the electrical activity of musculus rectus quadriceps for the sake of training with leg extension which means that focus was more on leg muscles activity (musculus rectus quadriceps). This does not lead to better and direct benefit on abdominal muscles from noticing high top of the curve between the abdomen and thigh and we notice that during electrical activity the top is bigger in musculus rectus quadriceps than abdominis which makes training clearly less important. It was also clear that the value of R.M.S of musculus rectus abdominis was bigger in bending position and this variable is counted by real values of strength. This is considered a clear important variable showing muscle's real strength, so abdominal muscles work better in case of training with knee bending as physical load on thigh muscles is reduced which means that the focus is on abdominal

muscles and this is the main purpose of training. Moreover, correct performance of training means less load on the spine as legs extend mechanically with big resistance and arms taking the length of legs which requires work till back muscles especially in case of not having help from other person to fix legs which makes the training person with legs attached to the ground which means more load on lumbar vertebrae which causes non-athletes injuries leading to be away from sport and practice normal work.

5. CONCLUSIONS:

1- Performing abdomen training with knee bending leads to better targeting towards abdomen muscles which was clear from muscle's electrical activity.
2- More participation of other muscles in positions of abdomen and legs extended, these muscles have special training that has to be applied separately.
3- Abdominal training performance from the position of legs extension forms more load on the spine which may result in some problems with time especially for non-athletes.

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