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A comparative study of some biomechanical variables of electrical activity of the muscle of the upper body between the front and back diagonal strikes in table tennis for men

By

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Abstract

The benefit of electromyography of the muscles is that it can be used as a diagnostic procedure that a doctor or researcher can use to evaluate the health status of that muscle and the neurons that control it. These neurons are known as motor neurons. The electrical signals cause the muscles to contract and relax and the EMG values convert these signals into graphs or numbers which help doctors and researchers to diagnose muscle and nerve function. (Al-Tikriti. 2020. 229)

The research aims to identify the values of multiple variables of electromyography activity for some of the upper body muscles between the front and back diagonal strikes in table tennis for men and the difference between them. The descriptive approach was used in comparative methods. The sample consisted of (6) advanced players. After reviewing a number of sources that used the ball throwing device, the most frequent test in the diagonal and straight research was chosen which is the front and back stroke tests (diagonal and straight) in table tennis .EMG was used to following muscles: Wrist Flexor-Biceps-Pectorals Major-Posterior part Deltoid-Trapezius-Rectus Abdominals. The researchers used arithmetic mean, standard deviation, and Wilcoxon matched-paired single range non-parametric statistical test. The following conclusions were reached

There were significant differences in the variable of biceps brachii muscle in Average crowding force between the diagonal strike forehand and the diagonal strike backhand in table tennis, and for the benefit of the backhand kick.

There were significant differences in the variable Maximum crowding force in forearm flexors muscle variables between the diagonal strike forehand and the diagonal strike backhand in table tennis in dorsal trapezius muscle, and for the benefit of the forehand strike.

There were no significant differences were found in other variables between the diagonal strike forehand and the diagonal strike backhand in the other muscles.

Hypotheses

The researcher hypothesized that there are significant differences between a number of electrical activity variables for some upper body muscles working in the front and back diagonal strikes in table tennis for men

Electromyography (EMG)

It is the process of recording the electrical activity of the contracting muscle and is another common way to study the movements. It shows the muscles' participation in the movement by amplification and recording through a polygraph recorder. (Schmidt.1982.6)

Literature Review

The study by Kondric Furgan et al.: conducted a Comparative study of electro muscular activity in table tennis forehand using balls of different sizes 2006. The study of Jin Lu Zia et al 2010: Surface electromyography of the muscles of the upper extremities in table tennis for the forehand. The study by Chien- Lu Tsai, Kuang-Min Pan, Kuei-Shu Huang, Ting-Jui Chang, Yin-Chang Hsueh, Lu-Min Wang, Shaw-Shiun Chang.of surface EMG activity of the upper limp muscle in the table tennis forehand drive. The study by Jin Lu Tsai et al (2012) Surface electrical activity of the upper extremity muscles in forehand strikes in table tennis. The study by Osman, Ameed. Farook (2022): "A comparative analytical study in a many of Electromyography variables of some upper body muscles working in the Forehand and Backhand strokes in men's table tennis".

Research sample

The research sample consisted of (6) advanced players who obtained advanced ranks in inter country Championship for applicants, and the research sample was chosen by the deliberate method.

Table (1) *Specifications of the research sample*

	Player Name	Age	Height	Weight	Training age	level
1	Hussein Omar Hussein	36	181	68	25	Asian and Arab champion
2	Siwan Jamal muhammad	32	179	76	21	Asian and Arab champion
3	Arya Idris Khader	19	172	51	9	Kurdistan champion
4	Diako Osman Ali	21	178	66	10	Asian champion
5	Ziyar Nawzad Muhammed	19	183	79	10	West Asian Gold Medal
6	Bakhtiar Abdul Baqi Qadir	35	173	80	21	Asian champion

The front and back diagonal strikes

The researchers operate the ball throwing device, which is placed facing the receiving player and at the level of the table and in the middle of it. The player blocks the serve and directs it to the box installed in the right corner (for the right player) and to the left corner box (for the left player opposite the player and his side length (50) cm and the attempt is considered successful when the ball falls into the box. The attempt is re-tried if the ball thrower from the device falls outside the circle, and the attempt is considered unsuccessful if the ball returned from the player falls outside the square.

Figure (1) shows the scheme of the research experiment for straight and diagonal backhands, the diameter of the circle is (50) cm, which is the area of the fall of the

transmission (the ball throwed from the ball thrower), and the dimensions of the re-transmission area square (50 x 50) cm.

The technical scientific observation was carried out using two cameras (iPhone-X max) at a speed of (260) images / sec), the following are the dimensions in which the two cameras were placed, The height of the player's camera from the side is (1) one meter, The side camera is 3 meters away.

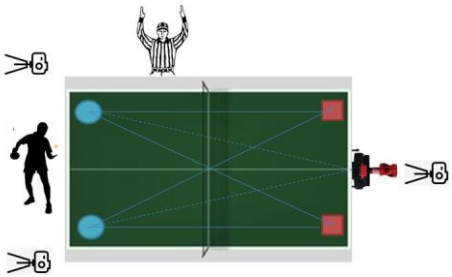

Figure (1): *The scheme of the research experiment*

Final Experiment

The final experiment was implemented on Thursday, February 25, 2021, in the closed hall at the College of Physical Education and Sports Sciences at the University of Sulaymaniyah, in the presence of the work team. The player is awarded (5) front diagonal strikes and, (5) diagonal back diagonal strikes. The device shoots single balls (intermittently) at a speed of (25) balls per second. The researchers used the arithmetic mean, standard deviation, and T-test (Wilcoxon matched- paired single rang nonparametric statistical test)

The data was treated statistically using the statistical package by (SPSS) (Al-Tikriti and Al-obaydi.2012.167-360)

From the table (2) the results of the research indicated that there were no significant differences in the variables of the triceps brachii muscle Between the diagonal strike forehand and the diagonal strike backhand in table tennis.

Table (2) *Differences in the electromyography variables of the triceps brachii muscle in the front and back diagonal strikes*

	variable	unit	forehand		backhand		t value	sin
			Mean	Standard Deviation	Mean	Standard Deviation		
1	Average crowding force	uV	285.34	166.82	288.63	91.54	0.055	0.958
2	Maximum crowding force	uV	686.29	224.50	691.86	191.89	0.068	0.948
3	Minimum crowding force	uV	17.11	6.63	13.44	2.81	1.271	0.251
4	Wave time	S	0.31	0.05	0.27	0.05	1.831	0.117
5	Area under the wave curve	Uv*s	28.14	28.14	71.43	22.14	1.009	0.352
6	Area under the wave curve /time	Uv*s/s	252.8	85.75	287.20	131.62	0.620	0.558

From the table (3) the results of the research indicated that there were significant difference in the variable of biceps brachii muscle Average crowding force Between the

diagonal strike forehand and the diagonal strike backhand in table tennis, and for the benefit of the backhand kick .No significant differences were found in the another variables.

Table (3): *Differences in electromyographic parameters of the biceps brachii muscle in the front and back diagonal strikes*

	variable	unit	forehand		backhand		t value	sin
			Mean	Standard Deviation	Mean	Standard Deviation		
1	Average crowding force	uV	130.69	75.60	137.04	137.04	2.425	0.042*
2	Maximum crowding force	uV	294.36	181.17	342.71	342.71	0.924	0.391
3	Minimum crowding force	uV	19.63	5.47	25.51	25.51	1.025	0.345
4	Wave time	S	0.31	0.05	0.27	0.27	1.831	0.117
5	Area under the wave curve	Uv*s	40.44	5.81	39.36	39.36	0.149	0.886
6	Area under the wave curve /time	Uv*s/s	132.87	37.04	151.65	151.65	0.570	0.589

Significant difference (6-1) = 5

From the table (4) the results of the research indicated that there was no significant difference in the variable of forearm extensor muscle Between the diagonal strike forehand and the diagonal strike backhand in table tennis

Table (4): *Differences in the electromyographic variables of the forearm extensor muscle in the front and back diagonal strikes*

	variable	unit	Forehand		backhand		t value	sin
			Mean	Standard Deviation	Mean	Standard Deviation		
1	Minimum crowding force	uV	195.51	75.70	218.07	85.98	0.464	0.445
2	Maximum crowding force	uV	465.71	274.30	494.09	152.88	0.198	0.654
3	Minimum crowding force	uV	19.09	8.16	26.26	10.76	1.301	0.240
4	Wave time	S	0.31	0.05	0.27	0.05	1.389	0.231
5	Area under the wave curve	Uv*s	48.41	15.11	82.17	86.90	0.938	0.352
6	Area under the wave curve /time	Uv*s/s	153.51	38.30	181.35	98.03	0.648	0.543

From the table (5) the results of the research indicated that there was no significant difference in the variable of forearm flexors muscle variables between the diagonal strike forehand and the diagonal strike backhand in table tennis in forearm flexors muscle.

Table (5): *Differences in the electromyographic variables of the forearm flexors muscle in the front and back diagonal strikes*

	variable	unit	forehand		backhand		t value	sin
			Mean	Standard Deviation	Mean	Standard Deviation		
1	Average crowding force	uV	195.51	75.70	218.07	85.98	0.464	0.445
2	Maximum crowding force	uV	465.71	274.30	494.09	152.88	0.198	0.654
3	Minimum crowding force	uV	19.09	8.16	26.26	10.76	1.301	0.240
4	Wave time	S	0.31	0.05	0.27	0.05	1.389	0.231
5	Area under the wave curve	Uv*s	48.41	15.11	82.17	86.90	0.938	0.352
6	Area under the wave curve /time	Uv*s/s	153.51	38.30	181.35	98.03	0.648	0.543

From the table (6) the results of the research indicated that there was no significant difference between the diagonal strike forehand and the diagonal strike backhand the posterior deltoid muscle in table tennis.

Table (6): *Differences in EMG variables of the posterior deltoid muscle in the front and back diagonal strikes*

	Variable	unit	forehand		backhand		t value	sin
			Mean	Standard Deviation	Mean	Standard Deviation		
1	Average crowding force	uV	106.43	20.30	115.70	115.70	0.938	0.384
2	Maximum crowding force	uV	304.11	144.02	281.84	281.84	0.430	0.682
3	Minimum crowding force	uV	19.33	11.68	20.56	20.56	0.229	0.827
4	Wave time	S	0.30	0.05	0.27	0.27	1.046	0.336
5	Area under the wave curve	Uv*s	41.34	11.82	42.64	42.64	0.216	0.836
6	Area under the wave curve /time	Uv*s/s	142.04	51.11	188.62	188.62	1.658	0.148

From the table (7) the results of the research indicated that there was no significant difference in the variable Average crowding force, Maximum crowding force and Minimum crowding force between the diagonal strike forehand and the diagonal strike backhand in Average crowding force and Maximum crowding force in table tennis in pectoralis major muscle, and for the benefit of the kick straight line. No significant differences were found in another variables

Table (7): *Differences in the electromyographic variables of the pectoralis major muscle in the front and back diagonal strikes*

	variable	unit	forehand		backhand		t value	sin
			Mean	SD	Mean	SD		
1	Average crowding force	uV	167.83	95.63	184.40	67.50	0.288	0.783
2	Maximum crowding force	uV	490.97	227.44	503.71	136.39	0.154	0.833
3	Minimum crowding force	uV	11.91	3.86	21.21	14.68	1.428	0.203
4	Wave time	S	0.31	0.04	0.27	0.05	1.761	0.129
5	Area under the wave curve	Uv*s	59.34	23.47	41.17	6.89	1.709	0.138
6	Area under the wave curve /time	Uv*s/s	18697	67.77	129.63	42.26	1.049	0.335

From the table (8) the results of the research indicated that there were no significant difference in the variable Average crowding force, Maximum crowding force and Minimum crowding force between the diagonal strike forehand and the diagonal strike backhand in rectus abdominis muscle variables and for the benefit of the kick straight line. No significant differences were found in another variables.

Table (8): *Differences in electrocardiogram variables of the rectus abdominis muscle in the front and back diagonal strikes*

	variable	unit	forehand		backhand		t value	sin
			Mean	SD	Mean	SD		
1	Average crowding force	uV	153.06	95.61	104.97	71.29	0.955	0.377
2	Maximum crowding force	uV	409.99	181.44	281.44	200.48	1.025	0.345
3	Minimum crowding force	uV	12.17	8.03	16.61	16.37	0.564	0.593
4	Wave time	S	0.31	0.04	0.27	0.05	1.761	0.129
5	Area under the wave curve	Uv*s	50.17	17.51	40.78	24.25	0.872	o.417
6	Area under the wave curve /time	Uv*s/s	167.75	79.92	138.97	66.64	0.763	0.475

Table (9): *Differences in EMG variables for the dorsal trapezius muscle in the front and back diagonal strikes*

	variable	unit	forehand		backhand		t value	sin
			Mean	SD	Mean	SD		
1	Average crowding force	uV	92.41	13.85	70.31	40.23	1.221	0.268
2	Maximum crowding force	uV	236.14	50.08	158.06	77.59	3.783	0.009*
3	Minimum crowding force	uV	13.23	12.43	5.66	3.22	1.510	0.182
4	Wave time	S	0.31	0.04	0.27	0.05	1.761	0.129
5	Area under the wave curve	Uv*s	37.53	15.47	30.66	9.98	1.469	0.192
6	Area under the wave curve /time	Uv*s/s	120.64	44.55	117.35	35.20	0.146	0.889

*Significant difference (6-1) = 5

From the table (9) the results of the research indicated that there were significant difference in the variable Maximum crowding force in forearm flexors muscle variables between the diagonal strike forehand and the diagonal strike backhand in table tennis in dorsal trapezius muscle, and for the benefit of the forehand strike .No significant differences were found in the another variables.

Conclusions and discussions

The significant difference in the variable of biceps brachii muscle in Average crowding force between the diagonal strike forehand and the diagonal strike backhand in table tennis, and for the benefit of the backhand kick.

- There were significant difference in the variable Maximum crowding force in forearm flexors muscle variables between the diagonal strike forehand and the diagonal strike backhand in table tennis in dorsal trapezius muscle, and for the benefit of the forehand strike.
- There were no significant differences were found in other variables between the diagonal strike forehand and the diagonal strike backhand in the other muscles.

The researchers attribute these differences to the fact that the frontal diagonal strike is almost completely performed by the biceps brachii muscle, in addition to the fact that the track of the racket's movement is consistent with the direction of the forward diagonal movement, while the back blow is largely performed by the triceps brachii muscle and the extensor muscles of the forearm as well as the same thing. For the dorsal great muscle, it takes over a movement that accompanies the torso with the movement of the arm so that the blow is effective.

Recommendations

The researchers recommend emphasizing the use of forward and backward diagonal strikes during training units using the thrower device and in actual play, as well as weight training and multigym devices to develop the muscular strength of the upper limbs and trunk, because the development of strength is positively reflected on the strength of the strikes.

Conducting a similar study of the relationship between the electrical activity variables of the muscles and the kinematic variables. And kinetic in table tennis and the muscles of the lower extremities in the same strikes.

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