Kinetic and Electromyography Characteristics Affecting the Performance of the Backhand with One Hand as a basis for design qualitative exercises in Tennis

Research Abstract

This study aims to identify some biomechanical and Electromyography characteristics affecting the performance of one-handed backhand strokes (flat - top spin) **as a basis for design qualitative exercises** in tennis. Researchers utilized the descriptive method involving a device to measure the muscles and analysis Electromyography employing video imaging and analysis of motor skill search using three-dimensional kinetic analysis software. This study was applied on a single IFT-registered Egyptian national team player. The results of the current study indicate that the highest momentum have emerged through the trunk and upper arm in order to produce strong backhand.

The importance of trunk work as it increases force distance transferred to the arm and the stability of the elbow joint and forearm is maintained by the contraction of the biceps and triceps.

The linear momentum of the trunk is more pronounced leftward, and upward trunk movements are essential for generating the necessary linear momentum of the racquet. Moreover, stabilization of the trunk is also considered to be very effective for the sequential transfer of high force and energy through the trunk work. The muscle activity producing movement is the (Deltoid posterior part), and in the muscles against is the (Erector spine muscle).

1-Introduction

Kinetics is a science that helps in and influences the scientific progress of motor performances considers studying sports movement through analyzing, clarifying, improving and developing the technique which gives accurate results in motor performance analysis and the identification of errors repositories. The analysis is a way to understand and be aware of sports movement and is studied as an integrated whole. 'This reflects the need by trainers to have a logical analysis of sports skills and access to performance details. Analysis is used in the sports field in order to identify the characteristics of skill technique and for the detection of the defects of performance and comparing it to the theoretical performance curves of the movement and prospects kinetic models.' (Metwaly,A 2008).

Refers (Hassan.Z.M (2004) In order to determine accurately the properties of sports activity, should we get the results through research which applied to high levels of the athletes, and whenever that research applied on the level of sports highest, the results more conform necessary for success in the chosen activity

The record characteristics kinetic and electromyography for higher level players mean use the values indicators and significant by comparing the performances at different levels by measuring the quantitative connotations of mechanical and functional status of the body of the player, either for the whole body or part of its parts.(Eldin.G.A,(1995)

Success in tennis is greatly affected by the technique a player uses. Biomechanics plays an integral role in strokes production. All strokes have a fundamental mechanical structure, and sports injuries primarily have a mechanical cause. (Elliott B., 2006), (Farag.E.w (2007).Backhand strokes are the second most ground strokes performed in games, and are one of the basic strokes in tennis and are accomplished by activating the motor chains for muscular activity, which integrate easily according to the consistency and compatibility of alarming patterns and lower extremities. (Alexandros et al.,(2010).

Moreover the force of a tennis stroke depends on the momentum transfer from the racket to the ball during the ball–racket impact. This kinetic striking motion chain opens linkage system from the lower extremities, to the trunk, to the upper extremity, to the hand and then to the racket. The proximal segments accelerate the entire system and sequentially transfer momentum to the distal segment (Lin-Haw Wang,(2010)..

Some studies (Bahamonde R., 2000) also indicate that the effective transfer of linear and angular momentum from the lower extremity, to the trunk, to the distal upper extremity is very important for an effective tennis backhand stroke. Linear and angular momentum may be described by segmental power transfer. The instant of force generation could represent a part of the contributions of performance in tennis strokes, and is already applied in tennis serve **(**Reid and Elliott (2002)**.**

During follow-up to researchers to championships Grand Slam, and through the analysis of the distribution of the final strokes in a rally as a function of point winning out come in elite level tennis players, it was revealed that backhand strokes are associated with a greater number of points of winning and poignant , especially when it is a final shot. (Bailey and Mc Garrity,(2012) In local matches the inability of players to perform backhand strokes with high efficiency is noted, which has a negative impact on results. Through their experience in tennis training, the researchers see that this is due to deficiencies in technical requirements that rely on biomechanical and muscular aspects,

Highlighted by (Farag, E, W(2007) In the linear momentum, angular momentum and the force they are effective characteristics of performance backhand, which clearly show during the acceleration phase, where the racquet and hand begins to drop below the ball. And the body effective use of the acceleration and deceleration of the body segments. And the importance of the findings from the study of these types of research, where she was one of the most modern trends in the training and assessment and provide the basic instructions for improving and directing the training process to reach the ideal performance. Researchers ' felt the importance of conducting this study as a basis to design qualitative exercise allowed under the guidance of trainers to most exercises similar to the skill in the current study as a scientific attempt to contribute to the achievement of the best motor performance of the backhand strokes.

2- Objective of the study:

- Identifying some biomechanical variables and some electromyography characteristics affecting the performance of the one-handed backhand strokes in tennis (flat - top spin)
- Define foundations that contribute to put up and design of quality exercises to develop the performance of backhand based on each of the (biomechanical and muscle variables) for the arrival of players to the outstanding performance

3-Research hypotheses

- There are some biomechanical variables and electromyography characteristics affecting the performance of the one-handed backhand strokes in tennis (flat - top spin)

4-Procedural design

Researchers utilized the descriptive method involving a device to measure the electric activity of the muscles and analysis electromyography employing video imaging and analysis of motor skill search using three-dimensional kinetic analysis software. This study was applied on a single ITF-registered Egyptian national team player. Table (1) illustrates the sample characterization.

Table (1)
Characterization of Study Sample

Variable	weight	length	leg	thigh	shank	foot	hand	humerus	forearm	palm
Amount	90 kg	181 cm	93cm	48 cm	45 cm	26 cm	98 cm	38 cm	31cm	20 cm

5-Programs used in the study procedures

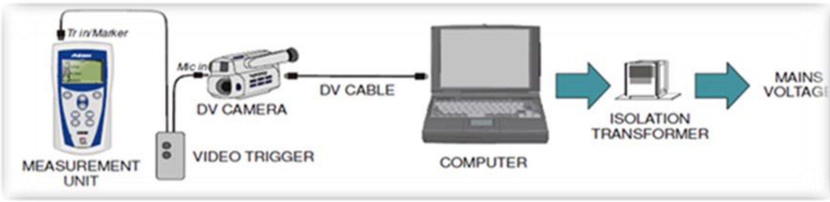


Figure (1)The Synchronization Programs

3D imaging was used through the synchronization program between the kinetic analysis camera (win analyze)and the Mega win 6000 EMG with camera frame rateof 100 frames/s (figure (1).48 surface electrodes have been placed on 16 of the most important working muscles under research after following the steps of theskill anatomical analysis.

The filming location was prepared by positioning ball launcher on either side of the court. Then the drawing scale was prepared and put in the filming scope. Camera No. (1) Was 8 meters away from the playing zone and in the direction of the player. It was 1,47meters high from the ground. Moreover, camera No. (2) Was10meters away, in the direction of the player and 1.47 meters high from the ground.

Player's preparation for imaging: His physical measurements are taken, and then filming-related guide signs are installed on the player's major body joints which are confronting the camera. In addition to that, the electrodes on the muscles surface involved in the performance are installed (E. Paul & Mark,2011) figure (2). The skill test is explained before the start of filming. A set of attempts were filmed and recorded from among which was chosen the best three of every type to apply the kinetic analysis and electromyography on them.

The researchers applied the procedures for the anatomical analysis. This took place through the phases of the technical performance of the skill and by identifying the most important instants for all the important instantaneous positions. These positions represent the fundamental changes occurring in the movement of each joint working during the performance, at which ends one of the movement phases and begins the next phase. These positions amount to 12 time instants. (E. Paul & Mark, 2011) also explains that the joints working during the performance are (the right ankle joint) - (the right knee joint) - (the trunk joint) – (the right shoulder joint) - (the right elbow joint) and muscular groups participating in the performance of the skill.

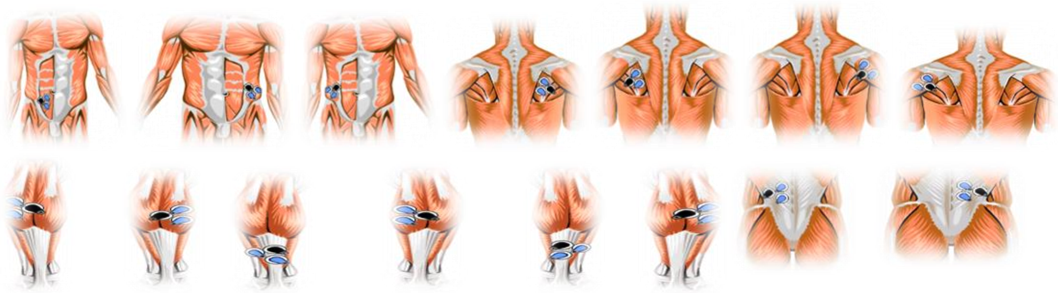


Figure (2).
Muscles Activity during One-Handed Backhand

6-Results

1-The results of biomechanical characteristics

Table (2)
Force and momentum of body joints and COG for flat

Skill performance phases		Introductory phase				Main Phase				Final Phase			
Selected time frames		1	5	6	7	9	11	13	15	17	18	19	20
Time (seconds) / variables		0	0.04	0.05	0.06	0.08	0.1	0.12	0.14	0.16	0.17	0.18	0.19
right upper arm	force (N)	0	64.498	51.501	71.093	72.478	57.755	121.442	99.375	76.045	143.272	80.85	52.988
	Momentum (Nms)	0	126.242	104.332	142.942	147.694	117.732	245.493	186.98	113.06	220.625	89.056	82.723
right forearm	force (N)	0	62.432	68.03	79.354	75.113	69.163	149.452	130.589	106.372	110.528	58.055	75.722
	Momentum (Nms)	0	121.854	129.488	151.328	146.699	135.03	282.088	229.148	119.676	183.146	111.779	150.001
right hand	force (N)	0	50.437	54.625	39.908	56.914	63.039	54.218	39.114	50.21	107.414	100.58	26.547
	Momentum (Nms)	0	81.97	89.229	77.909	104.566	122.49	84.245	61.76	25.765	198.977	183.577	48.096
right thigh	force (N)	0	261.732	427.209	293.953	22.721	126.36	62.772	47.691	17.568	49.558	14.216	143.948
	Momentum (Nms)	0	267.041	527.713	356.85	35.042	211.461	108.596	84.257	31.708	62.103	20.457	178.605
right shank	force (N)	0	0.706	0.681	0.775	0.818	0.526	0.248	0.124	0.103	0.117	0.134	0.165
	Momentum (Nms)	0	16.566	66.128	77.404	9.469	54.908	53.923	23.111	0.836	8.749	9.358	73.184
right foot	force (N)	0	3.298	2.004	2.006	1.359	0.926	1.822	2.023	0.554	2.038	0.715	0.589
	Momentum (Nms)	0	5.690	0.643	1.995	2.103	1.692	2.202	3.219	0.369	1.980	0.373	0.725
trunk	force (N)	0	637.162	143.995	452.016	435.767	612.773	598.766	535.87	469.052	743.7	853.088	210.299
	Momentum (Nms)	0	1076.285	274.236	823.684	792.95	1218.74	834.945	935.106	805.254	1133.973	1237.631	320.575
body cog	force (N)	0	1380.671	748.609	506.532	826.567	925.525	1110.444	956.02	749.559	1130.919	1125.762	264.184
	Momentum (Nms)	0	89.142	72.483	69.164	80.08	48.471	67.733	74.661	63.122	51.683	78.171	80.392

Table (2) illustrates that the largest amount of momentum for the thigh during the introductory phase was (527. 713)NMS and that the largest amount of force in the same phase was (427. 209) While it was in the main phase (211. 461)

NMS and (126. 36) N.The table also illustrates that the largest amount of the momentum and force of the trunk in the introductory phase is (1076. 285) NMS and (637. 162) N and in the main phase (1218. 74) NMS and (612. 773) N while the largest amount of momentum of the body's center of gravity path during the introductory phase was (89. 14) 2) NMS, while during the main phase it amounted to (80. 08) NMS

Table (3)
Force and momentum of body joints and COG for spin

Skill performance phases		Introductory phase				Main Phase				Final Phase			
Selected time frames		1	5	6	7	9	11	13	15	17	18	19	20
Time (seconds) / l variables		0	0.04	0.05	0.06	0.08	0.1	0.12	0.14	0.16	0.17	0.18	0.19
right upper arm	force (N)	0	136.58	58.144	44.855	33.149	121.841	249.094	131.248	149.146	161.08	55.504	23.769
	Momentum (Nm)	0	173.534	46.295	54.952	35.792	170.334	355.591	164.924	224.783	239.072	51.538	33.759
right forearm	force (N)	0	90.595	82.493	94.165	84.584	167.964	142.644	138.64	117.538	108.4	27.349	74.457
	Momentum (Nms)	0	81.856	57.257	64.314	38.558	211.807	186.453	135.579	176.254	140.698	28.798	110.148
right hand	force (N)	0	19.472	58.264	113.63	77.466	43.367	147.169	68.877	59.012	55.005	62.939	71.226
	Momentum (Nms)	0	1.88	55.185	108.05	37.181	47.923	171.907	91.649	59.542	76.485	59.457	15.454
right thigh	force (N)	0	502.139	216.504	305.995	412.376	189.69	23.401	120.53	172.106	100.782	96.36	395.788
	Momentum (Nms)	0	338.034	168.389	222.862	283.177	127.148	5.058	110.874	164.413	96.482	74.692	374.457
right shank	force (N)	0	-0.247	-0.171	-0.156	-0.377	-0.346	-0.387	-0.355	-0.053	0.041	0.055	0.056
	Momentum (Nms)	0	16.739	9.549	12.621	23.874	9.445	7.093	21.677	25.618	11.166	2.93	3.439
right foot	force (N)	0	20.34	2.1	20.566	2.097	16.55	7.29	0.889	0.994	0.619	0.659	0.363
	Momentum (Nms)	0	4.654	0.29	4.803	0.82	4.594	1.656	0.543	0.076	0.179	0.255	0.202
Trunk	force (N)	0	633.919	484.391	913.29	525.441	692.56	737.684	484.311	763.642	870.984	306.415	982.877
	Momentum (Nms)	0	511.747	464.237	1030.428	251.408	645.641	799.197	564.965	833.514	987.572	156.674	1247.049
body cog	force (N)	0	1465.639	1110.168	1059.332	926.268	1333.583	1480.68	867.991	1476.541	1082.49	376.916	1207.027
	Momentum (Nms)	0	28.903	26.291	30.132	35.976	26.971	42.012	44.457	13.556	6.123	6.162	7.058

The table shows that the curves of the force outcome of the center of gravity links increased (33.149) N to (149.146) N clearly with the joints of the striking arm during the main phase, while amounts of total force with the driving leg decreased from (20.34) N to (2.1) N during the preparation introductory phase.

Table (4)
Angles of body joints for flat

Skill performance phases	Introductory phase				Main Phase				Final Phase			
Selected time frames	1	5	6	7	9	11	13	15	17	18	19	20
Time (seconds / Body joints	0	0.04	0.05	0.06	0.08	0.1	0.12	0.14	0.16	0.17	0.18	0.19
right elbow	145.221	161.368	173.613	182.122	175.975	170.949	173.262	166.403	164.423	190.011	198.621	188.7
right shoulder	47.57	40.007	39.891	39.934	41.735	44.943	41.083	45.457	46.287	56.751	56.46	65.898
right trunk	106.025	116.89	113.844	114.024	114.067	116.947	116.15	121.738	125.03	126.433	128.635	129.238
right knee	134.196	131.279	125.753	125.094	124.027	122.873	119.645	123.005	122.343	122.054	123.164	122.143
right foot	102.368	94.242	92.065	91.116	89.215	86.774	84.476	84.231	82.716	81.97	81.968	81.254

Table (4) illustrates the importance of that the angle of the knee is between (134.196) and (119.645) degrees and that the angle of the elbow has increased during the beginning of the main phase between (145.221) and (175.975) degrees and that the shoulder angle has amounted to 46.287 degrees at the beginning of the same phase.

Table (5)
Angles of body joints for spin

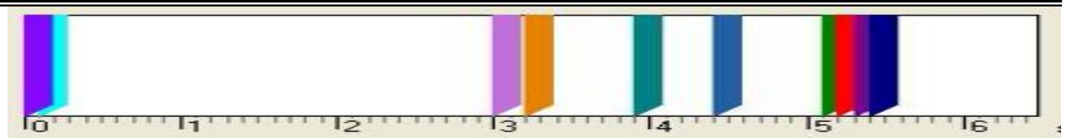
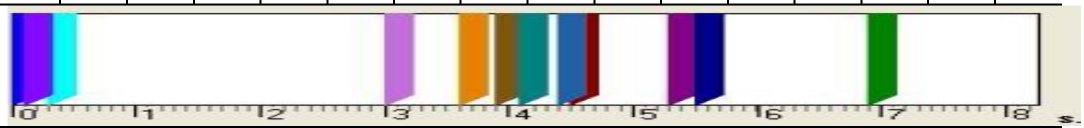
Skill performance phases	Introductory phase				Main Phase				Final Phase			
Selected time frames	1	5	6	7	9	11	13	15	17	18	19	20
Time (seconds / Body joints	0	0.04	0.05	0.06	0.08	0.1	0.12	0.14	0.16	0.17	0.18	0.19
right elbow	148.454	172.847	161.764	165.089	169.655	159.007	163.846	148.169	166.231	190.872	168.454	169.768
right shoulder	44.686	42.709	41.995	30.426	35.901	37.976	40.467	37.623	49.222	48.839	56.64	59.363
right trunk	125.299	127.381	129.882	138.901	138.557	138.616	141.318	145.47	157.222	158.833	159.936	160.983
right knee	128.083	133.772	136.12	141.568	143.332	143.73	145.581	148.926	151.65	152.685	153.508	154.721
right foot	83.933	92.373	93.029	92.6	93.452	89.913	90.067	91.213	92.047	92.092	91.894	91.88

Table (5) shows that the angle of the elbow has increased during the beginning of the main phase reaching (169.655) degrees, and increased more in the beginning of the final phase reaching (190.872) degrees

2- Results of electromyography Characteristics.

Table (6)

Activation and Deactivation muscle during motor performance (flat)..

Deactivation Muscle																
No. muscle and color	3	10	9	14	8	15	16	6	11	7	1	2	5	6	12	13
Delay time	0.00	0.00	0.10	3.00	3.20	3.90	3.90	4.40	4.40	4.40	5.10	5.20	5.30	5.40	—	—
Deactivation Muscle																
No. muscle and color	3	10	9	14	8	15	16	11	6	7	4	5	2	1	12	13
Delay time	0.00	0.10	0.30	3.00	3.60	3.90	4.10	4.40	4.50	4.50	5.30	5.50	5.50	6.90	—	—

The electrical response of the working muscle began its activity through the following groups (Infraspinatus muscle and Erector spine muscle with time(00.0 s), followed by electric activity (Deltoid muscle - posterior part)with time (10s), all of which are linked to the lower limb musclesin order to preserve the amount of movement necessary.

Table (7)

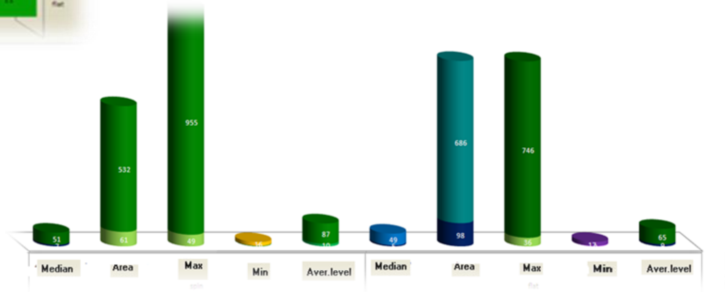
Activationand Deactivation muscle during motor performance (top-spin)

Deactivation Muscle															
No. muscle and color	14	15	16	7	8	1	10	2	3	11	6	9	5	12	4
Delay time	0.00	0.10	0.10	0.30	0.30	0.70	0.70	0.80	0.80	0.80	0.90	0.90	1.30	1.40	—
Deactivation Muscle															
No. muscle and color	15	14	16	6	7	9	8	3	5	10	1	2	4	11	12
Delay time	0.00	0.10	0.1	0.30	0.30	0.60	0.80	0.80	0.80	0.80	1.00	1.00	1.20	1.30	1.30

It is clear from table (7)that the following muscle has synchronization of work:the (Gastrocnemius muscle - medial part, Soleus muscle), with time 0.10s.

Figure (3)

The rate of contribution of the posterior deltoid muscle soleus was big despite its varying proportions while the rest of the contribution rate of the other muscles converged demonstrating Consistency and harmony in Performance with the proper streamlining and moves of muscle forces during the performance of skills.



Figure(4): the deltoid muscle is the one with the largest contribution in both flat and topspin where it has the highest amount of electric value reaching (746 uv) and the percentage of its contribution amounted to 15% where it was the lowest in electric activity reaching (17 uv), while the average electric value is (49 uv)

Table (8) Basic data (EMG)for one handed backhand (Flat)

ch	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Aver. Level(UV)	68	30	50	16	9	39	46	60	35	35	31	24	9	56	39	65
SD	125	47	29	23	21	48	58	65	53	44	24	16	5	68	38	80
MIN(UV)	3	12	7	6	3	3	6	17	3	2	2	17	6	14	4	11
MAX(UV)	746	343	159	201	175	247	278	276	283	239	139	66	36	537	219	352
AREA(UVS)	723	311	521	173	98	411	482	639	376	376	331	251	98	586	407	686
MEDIN(UV)	23	14	49	10	5	22	26	22	66	19	27	20	7	31	25	27

Table (9) Basic data (EMG)for one handed backhand (Top-spin)

ch	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Aver.Level(UV)	87	38	24	25	14	25	44	49	36	23	20	33	10	36	29	86
SD	146	53	44	20	20	17	39	48	29	27	38	22	7	54	38	94
MIN(UV)	8	12	5	7	3	3	7	16	7	2	2	16	5	12	3	4
MAX(UV)	955	323	295	99	105	175	215	269	215	143	264	106	49	358	172	332
AREA(UVS)	532	227	145	149	85	144	254	283	220	134	115	200	61	218	177	525
MEDIN(UV)	51	21	10	17	7	19	31	32	30	13	8	24	7	20	12	40

7-Discussion

Results of tables (2) and (3) refer to difference in momentum and amount of force through the phases of motor performance of the backhand stroke in the striking arm joints, the torso, the thigh, the ankle and the foot. This is consistent with (Bahamonde R.,2000)study which indicates that the effective transfer of linear and angular momentum from the lower extremity to the trunk to the distal upper extremity is very important for an effective tennis backhand stroke.

Linear and angular momentum may be described as parts of force and power transfer. Moreover, the instant of power generation could represent a part of the contributions in sports performance, a concept already applied in tennis serve and backhand stroke. The force of a tennis stroke is affected by the velocity of the racquet-head at its impact with the ball through the combinational succession of the flowing force from the feet, legs, trunk and arm to the racquet hand. (Kibler et al., 2004).

Researchers say that the effective role of the legs is indisputable since it represents the 1BH as a five-phase multisegment stroke involving trunk rotations (hip and shoulder alignments), together with rotation about the shoulder (upper arm), elbow and wrist (Elliott et al., 1978; Reid &Elliott, 2002; Wang et al., 1998). The strength of a tennis stroke depends on the transfer of the momentum from the racquet to the tennis ball during the contact of the ball with the racquet. As the motor performance is linked to the force of the impact and is always duplicated according to the theory of motor transport and juxtaposition between the striking arm and the driving leg to get a larger amount of force so that the driving force associated with the leg with the force of the striking arm in magnitude and direction.

This shoulder and hip alignment characteristics influence the racquet position at the end of the one-handed backswing, namely an augmented displacement in1BH (Reid and Elliott, 2002).The results of (Fancying et al.,2013) show a significant positive relationship between post-impact ball velocity and the hip and shoulder alignment rotation angles.(Elliott et al., 1995) also points out that the elite players 'mastering of the performance of the backhand stroke introductory phase helps them to increase the force of the stroke, and that the racket and shoulder alignment at the end of the backswing may be crucial in the development of trunk rotation. Observations of professional players have shown that many of them prepare for the backhand by positioning the racket parallel to the court fence. This extreme twisting of the trunk could be useful in the development of more angular momentum and thus racket velocity

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The results of the current study indicate that the highest momentum have emerged through the trunk and upper arm so as to produce strong backhand stroke. The (Wang et al.,2010) study confirms the more pronounced use of trunk rotation during the acceleration phase of the 1BH and leads to a larger angular momentum for the trunk and racquet compared with the upper extremity joints. In contrast, (Wang& et al., 2005) observes that the linear momentum of the trunk is more pronounced in the 1BH. The authors argue that forward, leftward, and upward trunk movements are essential for generating the necessary linear momentum of the racquet.(Elliott& Christmas, 1995) indicates that the rotation of the trunk and upper arm movement represents about 25% of the speed of the racquet during the stroke.

Results of tables(3)and (4) show that the angles of the knee.trunk,elbow and shoulder joints have increased significantly during the performance phases, especially at the end of the acceleration phase. Those results are consistent with the results of (Wang, & et al., 1998) study which indicates that in order to increase ball velocity or control the path of the ball, then spinning the ball is necessary. The shoulder, elbow and wrist joints are involved in the movement of rocketed acceleration at the stroke. The results of the movements of trunk, shoulder, elbow and wrist joints in the acceleration phase is the main movement of the trunk which is bending to the left in order to balance the body and to widen the distance for the forward swing. The main movement of the shoulder joint is abduction for speeding up the racket or accelerating it. The elbow starts to lengthen from the beginning of the acceleration phase and reaches hyper extension immediately after impact in order to benefit from the full effect of the principle of extension radius in order to increase speed peripheral which helps to increase the speed of the racquet.

From a functional point of view, racquet velocity in 1BH is the product of the relative rotational movements of (a) the seven angular velocity components involved with the preparation and (b) the velocity of the center of the shoulder joint that is the result of the angular velocity of the trunk and the velocities of the two hip joints centers, which are determined by the various rotational velocities in the lower extremities,.(Mester, 2006)

Tables (6), (7) describe the muscles that have the largest value of the electrical activity during the performance of the skill in question. These are the muscles of the upper extremity of **(Deltoid posterior part**): trunk muscles, **(Erector spinae muscle, Infraspinatus, External abdominal oblique, Rectus abdominis)**: muscles of the lower limb **(Soleus muscle, Gastrocnemius muscle - medial part, - lateral part). The** researchers have referred that to the increasing in the efficiency of sensory receptors in the working muscles.

EMG studies of the elbow and shoulder functions have shown moderate activity of the **triceps, middle deltoid, supraspinatus, and infraspinatus** muscles during the acceleration phase of the one-handed backhand (Morris et al., 1989). During the backswing phase, all these muscles together with the trunk muscles are extended then this is followed by concentric contractions during the forward swing, thus enhancing the production of force which leads to greater segmental rotations and more velocity.

(Phillip page&ToddsEllenbeker,2003) add that the working muscles in the acceleration phase which contribute in the push-off of the lower body part and the loading to start the rotation of the thigh are**(Gastrocnemius- Soleus-Quadriceps-Gluteals**). The muscles contributing to trunk rotation are the (**Oblique-**

Abdominals-back extensors-Erector Spinae). Moreover, those contributing in arm forward swing are the **(Infraspinatus- Deltoid- Serratus anterior-Trapezius-Triceps)** and the working muscles in the follow-up phase responsible for the trunk rotation are the **(Oblique-back extensors-Abdominals).** Muscles which are responsible for the arm deceleration are the **(Subscapularis (rotator cuff)-Pectorals major-Biceps-Wrist flexors).**

Results of tables (6) and (7) show that the electromyography characteristics of each of the activation and deactivation muscle (EMG) of the one-handed backhand strokes confirm that the activity are in the movement-producing muscle of the **(Deltoid posterior part),** and of the helping muscles which are the **(Erector spine muscle)** which stabilizes the joints with an almost equal capacity and which plays an important role in the stability of the shoulder joint.(Rio et al.,1988) study indicates that the role of external rotation and abduction in the striking arm during the backhand stroke shows through the high activity of the (**middle deltoid, supraspinatus, and infraspinatus)**muscles during the acceleration phase. The study also adds that the same muscles are most active during follow-through phase and represents the activity of the (**biceps brachial**) muscles to try to control elbow extension.

In this regard, both (Andrews & Escamilla, 2009) confirm that the **deltoids** muscles provide torque with an estimated contribution of 35-65% from the **middle deltoid**, 30% from the **subscapularis,** 25% from the **supraspinatus**, 10% from the **infraspinatus** and 2% from the **anterior deltoid**. During abduction, **middle deltoid** force has been estimated to be 434 N, followed by 323 N from the anterior deltoid, 283 N from the **subscapular is,** 205 N from the **infraspinatus,** and 117 N from the **supraspinatus.** These forces are generated not only to abduct the shoulder but also to stabilize the joint and neutralize the antagonistic effects of undesirable actions.

(Kibler WB., 1995) confirms that the **deltoid** muscle is responsible for moving the scapula through the insertions of three major muscle groups. In addition to that, the Great Latissimus Doris muscle is responsible for internal circulation and the **pectoral** muscle is not directly linked to the scapula, yet they play an influential role in the implementation of the stroke. In addition to that, the shoulder, the back and the trunk muscles each have a basic role in the stroke. These muscles include the **External abdominal oblique** and the, **Rectus abdomen** is, and they contribute to the lateral bending and rotation of the trunk since they are considered as sources of momentum from which results the linear speed of the arm and the hand at the instant of striking.

8-Conclusions:

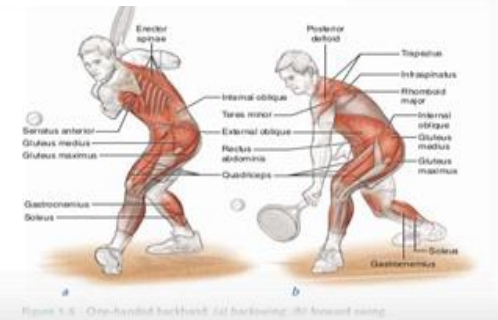

Figure (5) the Anatomy analysis of muscles involved in backhand stroke

The large muscle groups in the trunk and arm at the instant of striking, and the speed of the leg as it is pushing the determines the strength of the stroke. This means that the momentum transfer from one part to another of the body parts leads to the acquirement of the speed required by body parts as the kinesthetic result of result of force exertion. Ground reaction affects distal parts as a result of stabilizing the muscles. This is because the force resultant is produced from the relationship between the muscle and the external strength, that come as a result of the use the largest collection of muscle groups found in the lower part of the body with fast momentum transfer since stopping leads to losing a part of the speed and force gained.

In the acceleration phase, the trunk moves with the racket to increase angular momentum for the preparation of the impact. During this period, the movement of the shoulder is small. When the maximum angular velocities of the shoulder external rotation, elbow flexion and wrist extension occur in the instant prior to impact, they then immediately decrease. In this way, the hyperextension of the wrist joint, the cause of tennis elbow, may be prevented. The stability of the elbow joint and forearm is maintained by the contraction of the biceps and triceps

Researchers sees through the findings he must lay the foundations to design qualitative exercises in accordance with the results biomechanics and Electromyography from the study, and applying the foundations are designed qualitative exercise that suit specific physical abilities to performance the backhand stroke, agreement with pointed to it (Bereaa and Alsokary (2010) the need to design qualitative exercise according to the model of the movement used in competition according to the terms of : Proprioception, range of motion, the contractions of muscle groups, dynamic composition (time line of force) during the performance, qualitative exercise should correspond with the skill performance in movement and composition and the requirement in terms of (power-speed) and direction of work on the Biomechanics can contribute significantly to improving the training of the technical performance of the skill.

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