

Isokinetic assessment of shoulder muscle strength for tennis players

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Introduction and research problem:

Sports achievements and the development of performance levels have become the goal of every coach who seeks them through knowledge of his various means of analysis, evaluation and evaluation of every detail that leads to identifying strengths and upgrading them, standing on weaknesses and striving relentlessly for their solution, and providing scientific means that standardize the training process and those in charge of it has become one of our most important roles as academics.

Therefore, Zainab Omar and Ghada Abdel-Hakim (2008 AD) explain that the evaluation process, that is, the diagnosis, is the issuance of a judgment on the value of things, ideas, or responses to know their accuracy in light of a specific criterion level or standard, and it has many standardized scientific methods; For example, but not limited to, observation, questionnaires, evaluation scales, or interviews, all with the aim of collecting information that will be the basis for judging the effectiveness of training and educational systems and programs. (7:23)

In this regard, Zaki Hassan (2004 AD) points out that the isokinetic method is one of the most important methods of measurement and training. Which has become more famous in the last era in which we live, because of its innovative methods in the process of evaluating muscular performance related to muscular strength, which made it one of the most responsive methods to sports skills. (6: 127, 128)

Sherif Salih and Hatem Al-Duraini (2005 AD) see that tennis is one of the racquet sports that is characterized by strength and dynamic speed in its skillful performance, which assumes that he has a good level of physical fitness, the most important of which is strength, speed, flexibility and agility to achieve the level he hopes to reach. (8:80)

This is confirmed by Eileen Wadih Farag (2007) that tennis requires those in charge of the training process to prepare the players physically more effectively to keep up with the requirements of the physical burdens of the match well throughout the match period, so players with high physical capabilities achieve stronger hitting and faster movement on their shoes, and they also have the ability They are faster to recover and have the best control over getting the ball and returning it well, correctly and effectively. (2:278)

In this regard, William Bkibler (2007 AD) mentions that it is necessary for trainers to train highly on the muscle groups involved in skillful performance, which allows the muscles of the arms, shoulders, upper and lower back, as well as the two legs to achieve the required duty during performance without injuries, with accuracy, in a sequential and streamlined manner. . (31: 745-749)

In spite of the progress we are witnessing in the means of training and its various methods in the training process, we still witness many frequent injuries to tennis players, whether during training periods or during competition, and this is due to the player being late in his physical or skill levels, which impedes progress and access to levels. And through observation, we find that the most frequent injuries in the sport of tennis is the injury of the shoulder joint, which varied between an injury to the ligaments, tendons, or muscles working around that joint.

This indicates the importance of the isokinetic evaluation of the strength of the shoulder muscles of tennis players, as it is not devoid of the performance of tennis performances that give up the use of the strength of the shoulder muscles during the performance of hitting the ball or even preparing for hitting, as they are already the most susceptible to injury while neglecting the correct training appropriate to improve The force of contraction and diastole and achieving balance between some of the working muscles as well as the opposite (counter) around the shoulder joint, and thus impede the continuity of performance in an optimal manner during injury as well as its recurrence, which prompted the researchers to measure the force of torque around the shoulder joint of tennis players - the research sample - Which is represented in rationing the position of the body during the measurement process that results from the different muscle groups, and from here the researchers sought to evaluate the movements of the shoulder joint, which is the main factor for optimal performance in performing the basic strikes during the training period or throughout the match, by measuring the strength torque of the shoulder joint as an attempt From the researchers to guide the results when developing training programs for the development of strength for the sport of tennis.

Research goal:

This research aims to identify the maximum isokinetic torque of the strength of the shoulder muscles as a basis for developing training programs for tennis players.

Research questions:

In light of the research objective, the researchers ask the following:

- 1- What is the maximum isokinetic torque of the shoulder muscle strength of tennis players?
- 2- Are there statistically significant differences between tennis players in the moment of force?

Search terms:

Isokinetic contraction:

Maximum constant velocity muscle contraction, which is similar to the motor contraction of a skill (4: 124)

Reference studies:

Study "Omar Adel Saeed" (2016) (13)

Its title: "The effect of using some isokinetic exercises similar to free swimming movements by the two methods of high-intensity and repetitive interval training in developing the strength characteristic of the speed of the muscles of the arms and legs and the completion of the 50-m freestyle swimming." Developing the speed-distinguishing strength of the muscles of the arms and legs And the achievement of swimming 50 m freestyle, and the researcher used the experimental method, and the research sample included a sample of 12 students who practice swimming. who used high-intensity interval training.

Study "Al-Sayed Abdul Mardi Al-Sayed" (2015) (1)

Its topic: "Isokinetic evaluation of the strength of the shoulder muscles for judo players." This study aims to try to avoid injury by identifying the maximum torque of the shoulder muscle strength for judo players. The researcher used the descriptive approach on a sample of 21 judo players of different weights. There are statistically significant differences in the average force torque of the shoulder muscles between the different weight categories.

Study "Hanan Al-Sayed Abdel-Fattah and others" (2014) (5)

Its subject: "Muscular balance ratios of the muscles working on the knee joint for the triple jumper." This study aims to design a proposed program on the isokinetic device for the triple jumper to improve the level of work on the working muscles of the knee joint, the proportions of muscle balance on the working muscles of the knee joint, and the digital level of the race. The triple jump, the researchers used the experimental method on a sample represented by a player from the Egyptian national team for athletics in the triple jump competition. The proposed program improved the total work values of the muscles working on the knee joint, which led to an improvement in the performance level of the player, and there were differences in measuring the work ratio between the flexor muscles to the extensor muscles (flexion / extension) of the knee joint between the pre and post measurement, in favor of the post measurement in the knee. left.

Study "Wala'a Ahmed Hassabo Gouda (2011) (19)

Its subject: The effect of isokinetic training on the level of performance in the vaulting horse apparatus and some psychological variables. The chosen psychology, represented in (self-confidence and focus of attention), the researchers used the experimental method on a sample of

sports players with arm movement over the head, students of the third year at the Faculty of Physical Education for Girls in Cairo for the year 2010-2011. The most important results revealed that the proposed program for isokinetic training led to a significant increase in the level of skillful performance of the front somersault movement on the hands in the jumping horse apparatus for the experimental group, which changed its effectiveness and positive impact, despite the improvement of both the experimental and control groups, but the percentage of improvement It was much better for the experimental group in all research variables than the control group. The use of the proposed program for isokinetic exercises helps students to learn and develop the skill under study. The proposed program helps in improving the level of self-confidence as a trait and as a condition and the level of attention focus more than the followed program.

Study “Borms et al” (2016) (20)

Its subject: "Field tests of the upper part of the body and the isokinetic strength of the upper limb in overhead shooters." The researcher used the descriptive approach on a sample of 29 male and female players, and the most important results revealed that there is a moderate to strong correlation between the medical ball throwing test from above the head and the isokinetic measurements of the strength of the shoulder muscles. The results indicate the effectiveness of isokinetic measurements in assessing the strength of the shoulder muscles.

Study : Jabbier & Cecilia (2015) (24)

Its subject: The effect of using different resistances on the growth of the relative and absolute strength of the arm and leg and the total kinetic effectiveness of the students of the shot put. By using different resistances

on the growth of those powers and the level of achievement in the shot put, the researcher used the experimental method on a sample of 14 students at the Faculty of Physical Education divided into two experimental and control groups. The post-test compared to the control group also led to an improvement in the performance of the shot put.

Search procedures:

Research Methodology:

The researchers used the descriptive survey method due to its suitability to the nature of this research

The research sample :

Sample selection method: The two researchers randomly selected the research sample from the tennis players of El Shams Club (under 20 years old) who are registered in the Egyptian Tennis Federation.

Sample size: The sample of the basic study included (3) players and the number (1) player that was used in the exploratory study, and that became the total sample size of (4) players. That the sample is free from defects of normal distribution, as shown in Table (1) This is after ensuring the safety of the tools and devices and calibrating them. The researchers controlled the variables affecting the research, which are (age, height, weight, training age, and basic variables) - under research.-

schedule (1)

Characterization of the sample in the variables of growth rates and the basic variables - under research - to show the moderation of the data

N=4

variants	measruing unit	Mean	Mediator	Standard deviation	Skewness
Age	years	20.4	20	deviation	2.22-
Wight	K.G	72.30	72	1.67	0.43
height	C.M	176.7	177	2.09	0.73-
training age	Years	8.8	8	0.94	1.17
contractile moment	N / M	78.48	72.2	2.95	0.973
diastole moment	N / M	140.48	129.2	23.61	0.32

Table (1) shows the arithmetic mean, median, standard deviation, and skewness coefficient for the variables of growth indicative rates under study.

A- Research data collection tools:

- 1-Data registration form for each player from the sample. Attachment (1)
- 2- Personal interviews with the coaches and players to obtain their approval.

B- Tools and devices used in the research:

- 1-Restameter device for measuring total body length and weight in centimeters and kilograms.
- 2-A video camera.
- 3-Biodex3 isokinetic device for measuring muscle performance, equipped with a computer, screen and printer.

Iso Kinetic Dynamometer (Muscle Performance Testing)

It aims to measure the different aspects of muscular performance.

Attachment (2)

-The ability of muscles to exert torque around the different joints of the body during the different types of muscle contraction and also with muscle effort.

-Measuring the energy expended by muscles and the amount of work done.

Then we can identify the causes of poor muscle performance, which results in a weakness in the level of movement, which helps to accurately develop the appropriate program.

Exploratory study:

The exploratory study was conducted on Saturday 4/12/2021 AD, on a random sample of one player who was chosen from outside the basic research sample and from the same original community for the research.

The study targeted:

- 1- Identify the appropriate method for transporting the sample to the place of the application.
- 2- Identifying the extent of readiness of the place prepared for the implementation of the application.
- 3 -Learn about the capabilities of the device and how to perform the application.
- 4-Identifying the availability of the necessary safety factors when conducting the application.
- 5-Determine the appropriate range of motion for the joint to be measured (shoulder joint).
- 6 -Determine the sitting position that is commensurate with the axis of the shoulder joint, given that it is the joint to be measured
- 7- Identify the degree of resistance that will be used.
- 8- Determine the suitability of the chosen work system

This study resulted in:

The measurement process within the Muscular Performance Evaluation Laboratory took the following steps: Attachment (2)

- The two researchers entered the player's data on the device, which is (name - code - age - height - weight - side selection).
- The second step: the researchers set the components of the dynamometer (the rotation of the dynamometer - the height of the dynamometer - the stability point).
- The third step: the researchers determined the needs of the position of the seat in addition to the accessories of the device, which differ according to the type of part to be measured.
- The fourth step: The researchers determined the instructions for using the device for the sample under study.

Then, the researchers introduced the player to the device and determined the sitting position, which is commensurate with the axis of the shoulder joint as the first measurement of the player. 270° angle of the player), since if the full range of motion of the joint is not achieved, the device does not calculate each of the indicators (components) through which the moments of force are identified for each player, and then the player performs gripping and extension of the shoulder joint through a degree of resistance (60) degrees - Which was determined through the reconnaissance study by the signal that the device gives to the player, which is a (whistle sound).

Implementation of the basic study:**Basic search experience application:**

The basic study was applied in determining the measurements of the isokinetic force torque at the Faculty of Physical Education - Benha University for each player from the research sample, during the period from Monday 6/12/2021 AD to Wednesday 8/12/2021 AD

Statistical processors

Arithmetic mean - standard deviation - skewness coefficient – percentage

Presentation and discussion of the results and their interpretation:

Through the aim of the research, and by conducting statistical treatments appropriate to the nature of this research, and based on the results reached by the researchers, according to the results of the measurements of the players, the research sample, using the Iso Kinetic Dynamometer (Muscle Performance Testing) to measure the maximum torque of the contraction force (Flex), and the maximum torque For the strength of extension (Ext), and the maximum rate of contraction and relaxation (Rate), and that is about the ability of the muscles to exert torque around the shoulder joint, to show the causes of poor muscle performance, which results in weakness in most of the performances of the player's basic strikes. Which helps to develop a clear indicator of the player's condition, which can be used in developing scientific solutions to develop the performance level of the player's various strikes through designing the training program based on the scientific analysis of the player's shortcomings, so the two researchers will present and discuss the results of each player's measurements and analyze the results The players as a whole are as follows:

schedule(2)

The results of measurements of the first player's attempts in the search variables

Attempts	1	2	3	4	5	6	7	8	9	10
Flex1	102	100	100	115	107	120	105	110	108	110
Ext1	142	148	158	152	155	158	149	150	168	162
Rate1	%72	%68	%63	%76	%69	%76	%70	%73	%64	%70

The data in Table (2) indicate that the first player made (10) attempts and the maximum torque of the contraction force in attempt No. (6) was (120 N.m), and the maximum torque of the diastole force in attempt No. (9) and its amount was (168 N.m) and the maximum percentage of systole and diastole in trial No. (6, 4) was equal to (76%).

schedule(3)

Statistical description of the results of measurements of the first player's attempts in the search variables

Descriptive Statistics

Attempts	N	Minimum	Maximum	Mean	Std. Deviation	Skewness	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error
Flex1	10	100.00	120.00	107.7000	6.44722	0.599	.687
Ext1	10	142.00	168.00	154.2000	7.58361	0.297	.687

After analyzing the data of the player's attempts in Table (3), it was found, as shown in the previous table, that the player's average contraction force moment was (107 N.m) and its standard deviation was (6.447), and the average contraction force moment was (154.2 Nm) and its standard deviation was (7.584).). And looking at the values of the torsion coefficients about the strength of contraction and diastole, we find that their values range between (± 3), which indicates the strength trend of this player.

And through the results of the isokinetic evaluation of the strength of the shoulder muscles of the first player, it is clear that there is no balance in the outputs of the force in question between the muscles working on the shoulder joint and the opposite muscles (anti) on both sides of the joint in the first player during the performance attempts.

Schedule(4)

The results of measurements of the second player's attempts in the search variables

Attempts	1	2	3	4	5	6	7	8	9	10
Flex2	74	88	71	76	71	90	73	85	91	73
Ext2	129	119	123	110	122	114	116	120	112	125
Rate2	%57	%74	%58	%69	%69	%79	%63	%70	%81	%58

The data in Table (4) indicate that the (second) player made (10) attempts, and the maximum torque of the contraction force was in attempt No. (9), and its value was (91 Nm), and the maximum torque of the contraction force was in attempt No. (1). Its value is (129 Nm), and the maximum percentage of systole and diastole in attempt No. (9) was (81%).

schedule(5)

Statistical description Results of measurements of the second player's attempts in search variables

Descriptive Statistics

Attempts	N	Minimum	Maximum	Mean	Std. Deviation	Skewness	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error
Flex2	10	71.00	91.00	79.2000	8.27043	0.498	0.687
Ext2	10	110.00	129.00	119.0000	6.01849	0.054	0.687

After analyzing the data of the player's attempts in Table (5), it was found, as shown in the previous table, that the player's average contraction force moment was (79.200 N.m) and its standard deviation was (8.27043), and the average contraction force moment was (119.00 Nm) and its standard deviation (6.01849). And looking at the values of the torsion coefficients about the strength of contraction and diastole, we find that their values range between (± 3), which indicates the strength trend of this player.

And through the results of the isokinetic assessment of the strength of the shoulder muscles of the second player, it is clear that there is no balance in the outputs of the force in question between the muscles working on the shoulder joint and the opposite (anti) muscles on both sides of the joint in the second player during the performance attempts.

schedule(6)

The results of measurements of the third player's attempts in the search variables

Attempts	1	2	3	4	5	6	7	8	9	10
Flex3	69	88	79	85	66	92	64	77	86	67
Ext3	146	166	142	158	170	148	160	159	172	149
Rate3	%47	%53	%56	%54	%39	%62	%40	%48	%50	%45

The data in Table (6) indicate that the (third) athlete made (10) attempts, and the maximum torque of the contraction force in attempt No. (6) was (92 N.m), and the maximum torque of the contraction force was in attempt No. (9). Its value is (172 Nm), and the maximum percentage of systole and diastole in attempt No. (6) was (62%).

Schedule(7)

Statistical description: The results of measurements of the third player's attempts in the search variables

Descriptive Statistics

Attempts	N	Minimum	Maximum	Mean	Std. Deviation	Skewness	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error
Flex3	10	64.00	92.00	77.3000	10.26374	0.08	0.687
Ext3	10	142.00	172.00	157.0000	10.43498	0.048	0.687

After analyzing the data of the player's attempts, it was found, as shown in Table (7), that the average moment of contraction force for the player was (77.300 N.m) and its standard deviation

(10.26374), and the mean torque of the tensile force was (157.00 N.m) and its standard deviation was (10.43498). By looking at the values of the torsion coefficients about the strength of contraction and diastole and the ratio between them, we find that their values range between (± 3), which indicates the strength trend of this player.

And through the results of the isokinetic evaluation of the strength of the shoulder muscles of the player, it is clear that there is no balance in the output of the force in question between the muscles working on the shoulder joint and the corresponding (anti) muscles on both sides of the joint in the third player during the performance attempts.

And through tables (2, 3, 4, 5, 6, 7) and the above listing and explaining the results of the research sample players from the first player to the third player, it is clear that the results have shown the maximum isokinetic torque of the strength of the shoulder muscles for each player separately, which is the matter Which indicates that the researchers have verified the validity of the first question, which states what is the maximum isokinetic moment of the strength of the shoulder muscles of the tennis players - the research sample -?

Schedule(8)

Significance of the arithmetic averages of the research variables of the sample under study of tennis players

The research sample	The first player	The second player	The third player
Flex	107.700	79.200	77.300
Ext	154.200	119.00	157.00
Rate	%69.84	%66.55	%49.24

And among the results of Table No. (8) compiled for the average results of the players during the performance of the ten attempts on the isokinetic device to assess the strength of the shoulder muscles of the high-level tennis players, the research sample. The arithmetic average was (107.700 N.m), followed by the player (second) and the arithmetic mean was (79.200 N.m). The lowest player in the moment of contraction force was the player (the third), where the arithmetic mean was (77.300 N.m).

And in the results of the maximum torque of the extensor force (Ext), it was also found that the highest arithmetic mean was for the player (the third), as it was the arithmetic mean (157 N.m), then followed by the player (the first), where the arithmetic mean was (154.200 N.m) and was less Determination of the diastolic force of the player (second) was arithmetic mean (119 N.m).

In the results of the ratio between the maximum force moment of contraction and the maximum force moment of diastole (Rate), it was found that the highest arithmetic average was recorded in favor of the (first) player, and its rate was (69.84%), followed by the player (for the second), whose percentage was recorded (66.55%), and the lowest arithmetic average was for the player (Third) and its rate was (49.24%).

Therefore, it is clear from the results of Table (8) that the players have a large difference between the arithmetic mean of the moment of contraction and the arithmetic mean of the moment of diastolic force. This indicates that these players do not achieve muscular balance due to the strength of contraction and relaxation, which is what tennis players must have in order to avoid injury. In this regard, Muhammad Jaber Bareeqa and Ihab Fawzi (2005) confirm that disturbance of the muscular balance of the muscle groups working in performance and the corresponding muscles must be avoided. (anti) on both sides of the joint in order to maintain muscular balance. (16:34)

In this regard, we find that the muscles within the locomotor system are arranged in an organized manner, in a way that does not lead to the passage of the tensile forces directions through the axes of the joints, and this results in the muscle force and its main distance, which separates it from the axis of rotation, which is what is called the torque of the muscle force or the torque of the force. And since the muscle permanently produces a force of action and reaction, according to the law of action and counter reaction, there are two moments of force, and in the case of static muscle tension, the moments of muscular force must work so that the parts of the body maintain their balance towards other moments. (15: 138)

And Talha Hossam El-Din (2014) indicates that when the movement occurs in the direction of the resulting moment, the moment in this case is known as "concentric" shortening, but if the movement takes place in the opposite direction, it is known as "eccentric". (10:142)

This is confirmed by the study of Hani El-Deeb (2003), Emery et al., Emery, et al (2005) about the need to pay attention to the balanced development of the strength of the working muscles and the corresponding ones on the same joint during the programs designed for strength training, and this leads to avoiding the occurrence of Injuries. (18: 48), (22)

Talha Hossam El-Din (2014) believes that the regular practice of many sports activities, with a focus on the muscle groups required by the nature of performance in the practiced activity, and neglecting the training of the corresponding muscle groups, leads to an increase in muscle strength without matching the strength of the corresponding groups, which exposes them to increased stress and makes them more susceptible to injury. As a result of an imbalance in strength between the opposite muscles. (9:24)

Abdulaziz Al-Nimr and Nariman Al-Khatib (2007) agree that when a muscle or muscle group contracts, the antagonistic muscle or muscle group relaxes so as not to hinder movement. The contraction of the prime-mover muscle or muscles to stop its movement, which requires parity between the strength of the working muscle or muscle group with the strength of the muscle or muscle group corresponding to it. economical in performance. (11:26)

This is consistent with the study of Ayman Abdo (2003) on the need to develop the muscle strength of the working (moving) muscle groups in performance and the corresponding (counter) ones, that balanced strength programs lead to avoiding injuries. (3)

Borms, D., et, al (2016) sees that muscle strength is gained and improved during the early stages of training by using strength training devices, which allow controlling the resistances, whether during muscle contraction or relaxation, in proportion to the goal of the program, whether it is for training or rehabilitation. (20)

Therefore, the study of Shivsharanappa (2016) (28) agrees.

Peric et al (2015)(26), Palao & Valdes (2013)(25), Ekstrand et al (2013)(21), Van Den Tillaar & Marques (2013) (30), Sell (2013) (27), the importance of evaluating strength through clinical tests of strength to measure the strength of the upper body of the players of throwing sports from above the head, as confirmed by Birch et al. Peric et al (2015 AD) (26) that the difference in the level of strength The central musculature leads to a difference in the growth of strength in the upper limb, which leads to a difference in the throwing distance, which reflects positively on their performance levels.

It is also consistent with what was confirmed by Abdulaziz Al-Nimr and Nariman Al-Khatib (2005) that the success of any training program is based on the development of muscle strength, as he indicated that performance improves if the training is specific to the type of activity practiced and includes the muscles working in the performance and the corresponding muscles, which are developed in special ways according to how use in competition. (11:187)

Essam Abdel Khaleq (2005) and Mohamed Hassanein (2004) agree that muscular strength is one of the most important physical and motor capabilities that affect the level of performance in sports activities. Practicing muscular strength exercises on a regular, varied and gradual basis in terms of size and intensity helps to gain and grow strength. (12: 85), (17: 217)

The results of Borms et al (2016) (20) also agree on the effectiveness of isokinetic measurements in assessing the strength of the shoulder muscles, and the study of Peric et al (2015) (26) the difference in the level of central muscle strength leads to a difference in the development of strength in the upper limb Which leads to a difference in the distances of hitting or throwing, and the results of the study indicate Fatima Ratib (2008) (14), Trey et al. Treery.J.et al (2005) (29), Zakes Athans et al. al. (2005) (32), Evetovich et al. (2001) (23) on the importance of using isokinetics in evaluating muscle work (torque - work - capacity - muscle work ratios in terms of strength).

Therefore, from the foregoing, and given that it is difficult from a scientific point of view to measure the force resulting from the work of any muscle during the performance of most sports skills, the measurement or estimation of the combined joint moment, or as it is called the joint moment, is the most widely used in this field. The researchers aimed to use the isokinetic device to measure the force moments of the muscles operating on the shoulder joint in order to reach the values of the moments of these muscles, given that tennis is one of the sports in which the component of motor ability is required to achieve the best performance in serving strikes and other major strikes in the field. This is what was shown by the results of the isokinetic evaluation of the isokinetic torque differences on the shoulder joint between the players, the research sample, which is a clear indication of the strength of the player's muscles and their muscular balance, which contributes to the development of the player's performance through a training program that benefits from these results, and thus the researchers have achieved Is there validity of the second question, which states that there are statistically significant differences between the tennis players - the research sample - in the moments of strength?

Conclusions and recommendations:

First: Conclusions:

In light of the objective of the research and the procedures followed and within the limits of the research sample and statistical treatments and the results of this research, the researchers can conclude the following:

- 1- The periodic exchange between the maximum torque of the contraction force and the maximum moment of the diastole force, which leads to a high level of the player's athletic performance.
- 2- When the strength moments rise to the strength of diastole, it affects the level of the athlete positively.
- 3- Decrease in the flexural force moments and the diastolic force moments, as it negatively affects the progress of the athlete's level.
- 4- The isokinetic evaluation gives indicators of the maximum torque of the force of contraction and diastole and the maximum ratio of contraction and diastole, as well as indicators of muscle balance for the strength of the shoulder muscles of the tennis players, the research sample.

Second: Recommendations:

Within the limits of what was shown by the results of this research and the sample to which the measurements were applied, the researchers recommend the following:

- 1- The isokinetic device is used for measurement and training.
 - 2-Using the isokinetic device to measure or improve the total work values of the muscles working on the different joints to improve the level of performance.
 - 3- Benefiting from the isokinetic evaluation of the strength of the shoulder muscles of tennis players to determine the player's physical condition in general and the arms in particular.
 - 4-Guided by the values of the indicators of the research measurements on the isokinetic device that the study reached in tennis training.
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- 1- Interest in using the isokinetic device in developing muscular balance of the muscles working around the joints, which have a role in performing the basic skills of tennis.
 - 2- Application of the isokinetic device software to measure the rest of the racket sports.
 - 3- The need to pay attention to training players on strength training towards developing muscle balance.
 - 4- The need for coaches to be interested in identifying the stages of increasing, steady, and decreasing strength in each player by means of biomechanical analysis separately.
 - 5- The necessity of qualifying the trainers by studying biomechanics and its various means for the possibility of developing the motor performance of the players.

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Abastract

Isokinetic assessment of shoulder muscle strength for tennis players

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This research aims to identify the maximum isokinetic torque of the strength of the shoulder muscles as a basis for developing training programs for tennis players.

The researchers used the descriptive survey method to suit the nature of this research on 3 players under 20 years old who are registered with the Egyptian Tennis Federation.

The most important conclusions:

- 1- The periodic exchange between the maximum torque of the contraction force and the maximum moment of the diastole force, which leads to a high level of the player's athletic performance.
- 2- When the strength moments rise to the strength of diastole, it affects the level of the athlete positively.
- 3- Decrease in the flexural force moments and the diastolic force moments, as it negatively affects the progress of the athlete's level.
- 4- The isokinetic evaluation gives indicators of the maximum torque of the force of contraction and diastole and the maximum ratio of contraction and diastole, as well as indicators of muscle balance for the strength of the shoulder muscles of the tennis players, the research sample.