The Effect of Training with Rubber Ropes and Controlling the Resistance Arm on the Response Time and some Biomechanical Variables for the Skill of Sending for Wheelchair Tennis Players

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Abstract

Training with rubber ropes is one of the modern training methods that help to develop the absolute strength of specific parts of the body and according to the skill performance, especially when training with different muscle moments that cause the movement of those limbs according to variable resistances, especially for wheelchair tennis players, so the research was applied to a sample of tennis players with chairs Using these exercises to find out their effect on the serve skill mechanism, this exercises were applied for a period of (10) weeks, on (6) players who are the best players in this competition, and the researcher used foreign and Arab sources and the international information network, observation, experimentation, tests and measurements as means of collecting information.

A video camera for filming and using kinematic analysis to extract the mechanical variables, and the researcher came up with several conclusions, including that training according to the results of the analysis and using the change of resistance arms when training with rubber ropes was effective in developing the speed of the centers of the striking arm parts of the research sample. The exercises led to an improvement in the technical performance interdependence (the research sample), which inevitably affected the achievement of good achievement, as well as in improving the response time of the research sample.

Keywords: *Resistance arm, response time and control.*

Introduction

Training with rubber ropes is one of the modern training methods that help to develop the absolute strength of specific parts of the body and according to the skill performance, in order to develop the forces that cause the movements of those parts for the various sporting activities whose performance is related to the movements of the upper extremity, such as the skill of ground tennis, including wheelchair tennis. And since the movements of the upper limbs of the body of a disabled person in the game of ground tennis are relied upon in the application of basic skills in this game, which are often rotational movements, the muscular work will be related to the action of the various muscle moments that cause the movement of those limbs, and when the force is exerted by the muscles, this force It will work to rotate the associated parts around the joints of the body and whenever the level of muscle strength is large, the movement of these limbs will be as fast as possible, and thus the speed achieved in the limbs will contribute to the overall linear velocity of the body when performing the front and back blow or the serve with tennis, which requires the development of strength by controlling the resistance arm when it is shot on the arm and at different distances from the arm in order to develop the torque of force and develop the speed gain for it, given that the parts of the body contributing to the performance are levers whose movement is related to the presence of force and joints around which these parts must be used in

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the service of the skillful performance for this activity,[1] which requires a careful study of the motor performance And the consequent conditions and biomechanical laws in order to reach the correct technical position to achieve the best achievement, so the importance of research came to focus On the strength training exercises for rubber ropes for wheelchair tennis players, which are related to exercises based on the principle of moments, and to determine the importance of the work of these moments in the development of some biomechanical variables and the speed of response to them.[2]

The types of resistance forces have varied as training momentum, which "are of unequal magnitudes and opposite directions or in one direction in the end that support each other in order for the body to move accordingly and change its speed and direction of movement",[3] which is imposed on the body simultaneously as (the moments of the force of gravity And resistance force moments when training with added weights, body weight, or rubber ropes) During skill performance, most coaches and players were interested in strength training with various resistances, which are known as "sports movements that are similar in composition in terms of the combination of kinetic performance of strength and speed" ,[4] through the use of the best training methods that play a role in influencing the development of strength, including training rubber ropes of various lengths and resistances in various forms, as well as methods of training this regular force, and special strength according to the principle of moments as one of the effective training methods in this field Which is believed to be in addition to its effectiveness in developing muscle strength and ability when performing arm and trunk angle movements in accordance with the mechanical conditions accompanying performance, it can improve performance. The interest of coaches and players in most developed countries of the world has increased in resistance power training according to the levers, which has achieved positive results for their players, and these exercises narrowed the gap between strength and speed, as some researchers indicated that there is a gap in training programs between the strength that the player acquires. In cases of weight training and weightlifting and use in effectiveness practice. One of these gaps is mechanical explosive power, which uses force and velocity, its application in effective effectiveness, and the effective method for its development .[5]

The researcher promised that this is one of the scientific problems related to the applied training aspect related to the application of mechanical conditions, which may give limits to the skillful performance of the wheelchair tennis player in Iraq, so the researcher tended to use rubber rope exercises by changing the resistance arm to develop the strengths of the muscles working with ground tennis skills For this category, especially those related to the laws of momentum, the law of instantaneous propulsion and final velocity, and these laws directly affect the biomechanical variables for these skills. The aim of the research is to identify the values of some biomechanical variables for the skills of ground tennis for wheelchair players, to prepare strength training exercises for the working muscles, to identify the effect of momentum training exercises on some biomechanical variables and the speed of response to them. The researcher assumes the existence of statistically significant differences between the pre and posttests of some biomechanics and the speed of response to a sample search.

Research Methodology

The use of the experimental approach to suit the nature of the research. The sample of his research consisted of elite wheelchair tennis players from the Karbala governorate team, and their number was (6) players. They are the best players in this competition and who are preparing to participate in the Iraq Championship 2020. For their lengths (1.76) with a standard deviation (± 0.05).The researcher used foreign and Arab sources and the international information network. Observation, experimentation, tests and measurements as means of collecting information, as well as using a (2) Japanese-origin Casio video camera with a speed of (120) r / s and a computer

Automated (laptop Lap top) Lenovo type, and a height and weight measuring device. And rubber bands of different resistors and lengths.

Tests and measurements

A test of the skill performance of the serve and the pre-filming

The serve skill test of the search sample was conducted

in accordance with the rules of the International Tennis Federation with the conduct of videography, using a video camera at a speed of 120 p / s, for the purpose of analyzing and extracting the variables for the search, and this camera was placed so that the player's movement is photographed from the weighted moment to receive the ball (as a preparatory position) For the purpose of hitting the transmitter skill, the camera was 7 m away from the midpoint of the path, to ensure the player's movement was followed, and the height of the camera lens was (1.55 m) perpendicular to the ground.

Bio-mechanical variables

The following biomechanical variables were measured through direct sample imaging and kinematic analysis during pre and posttests, and they are:

velocity variables

1. The speed of the center of the shoulder, elbow and hand of the striking arm according to the following law: [6]

Angular velocity = angular velocity (for the forearm or upper arm) / time, then extract the circumferential velocity of the hand and shoulder according to the equation (peripheral velocity = angular velocity (in sector / s) ÷ N

The variables of the two equations were extracted through video kinematic analysis of the forehand and serve skills.

· The ball's launch velocity was extracted from kinetic analysis.

· Response time: measured with the Nelson Kinetic Response Test.

The Nelson Test for Selective Kinetic Response.[7]

The purpose of the test: to measure the ability to respond and move quickly according to the stimulus test.

Necessary tools

· The tennis court: a flat area free of obstructions with a length of (20 m) and a width of (2 m) within which there are three lines of distance between the line and the other (6.40 m), and the length of the line in the middle (1 m).

· An electronic stopwatch, a tape measure-recorder/that calls the names first and records the time of performing the test second. Timer/give start signal with timing.

Performance specifications

The player stands at one end of the middle line facing the timer who is standing at the end of the other end of the line and the player takes the standby position so that the middle line is between the feet, then the player prepares with his chair, and the timer holds the stopwatch with one of his hands and raises it to the top and then quickly moves his arm to the left or the right and at the same time he turns on the clock and when the player responds to the start signal, he tries to move with his chair as quickly as possible in the specified direction to reach the side line that is 6.40 m away from the center line, and when the player crosses the right side line, the timer stops the clock.

Test Instructions

· If a player starts in the wrong direction, the timer continues to run the clock until the player changes direction and reaches the right side line.

· The player is given (6) consecutive attempts between each attempt and the other (20) seconds of rest, with (3) attempts on each side.

· The attempts on each side are randomly selected and sequenced.

· The timer must train the start signal in order to be able to give this signal by the arm and operate the watch at the same time.

· The player must not know the number of attempts required of him to perform in order to reduce the player's expectation.

· The test should start with the timer displaying the (prepare - start) indication for all attempts.

Recording method: The time for each attempt is calculated to the nearest 1/100 second.

Lab score is the average of the six attempts (total score = total attempts ÷ 6 = 0.00 s).

Pilot study

The researcher conducted an exploratory experiment on (10/12/2019) on the sample members in order to adjust the performance of the devices used and to establish the location of the cameras and their preparation completely and the clarity of the images in them. And to identify the obstacles and errors that accompany the research procedures.

Pre-test and videography

The researcher conducted the pre-test and videotaping on (12/12/2019) at the specialized center of the Sports Talent Center for Tennis in Karbala, the researcher conducted performance tests and videotaping and took the test in accordance with international law.

Exercises applied

Restricted strength training (with rubber bands) was applied at the rate of (3) training units per week for a period of (10) weeks and at (30) units by using rubber ropes, which could contribute to the development of the strength level of the sample members according to mechanical conditions, and the exercises focused on special strength according to The theory of force moment (strength x length of the part of the movement), whether the arm or the torso part, and it was given (3) types of exercises in one training unit and these form types of exercises related to skill, movement of the body and the performance of movements that rise with the presence of resistances, as the intensity of these exercises Ranging from (85-95%) of the maximum intensity of the player according to the type of work performed, and a rest period was given according to the working time to rest between repetitions and (2) two minutes between one group and another, and it was carried out by the method of repetitive and interval training with high intensity and the training time was part of the main section within the training unit ranges between (30-40) minutes and the corrugation was (3: 1). The group was subjected to the direct supervision of the researcher with the help of specialized trainers.

The exercises started on 12/18/2019 and ended on 2/10/2020 ,the researcher conducted the test and videotaping on (2/13/2020) at the Sports Talent Center in Karbala, taking care to provide all the same conditions for the two tests.

Results and Discussed

Table 1. Shows measurements of the velocity variables of sending skill for the sample

Variables	Tests	Units	Mean	SD	Mean diff.	SD diff.	(t) value*	Moral level	Type of significance
The speed of the center of gravity of the body	Pre	Meter/ Sec.	1.23	0.230	.35	0.106	3.3	0.0000	Sig.
	Post		1.58	0.240					
Shoulder center velocity	Pre	Meter/ Sec.	2.32	0.55	1.53	0.394	3.88	0.000	Sig.
	Post		3.85	0.63					
Attachment center speed	Pre	Meter/ Sec.	6.88	41.95	2.04	0.294	6.94	0.002	Sig.
	Post		8.92	21.21					
Hand center velocity	Pre	Meter/ Sec.	12.12	1.63	2.53	0.837	3.02	0.021	Sig.
	Post		14.65	1.67					
Cruising speed	Pre	Meter/ Sec.	21.70	0.550	2.04	0.453	4.50	0.000	Sig.
	Post		23.74	0.630					

*Significance at ≤ 0.05 significance level.

The aim of the research was to study the effect of strength training with rubber ropes with changing arms of resistance in the development of some biomechanical variables for the skill of sending for tennis wheelchair players. There was an evolution in the values of this velocity for the sample members in the dimensional tests, as the development of velocity, whether for the center of gravity of the body or the centers of the joints of the body, is a result of exerting force and its development, because the speed and its development are related to the speed of body parts (such as the speed of the hip, the speed of the elbow and the hand) with the development of force, The more force there was, the more speed, and this is what appeared to the group members during the post tests in each of the hip velocity, the center of the shoulder axis,[8] the elbow and the hand as well as the speed of the head of the racquet, as the researcher used rubber bands according to the skillful performance to develop the muscle groups working on these joints As well as the development of velocity values for these centers.[9]

The important factor that helps to achieve the fastest possible speed, both when performing the skill of sending and beyond, is the increase in muscle effectiveness and its ability to effectively extend the working joints, which has been emphasized during exercises in which resistances are used as momentum (resistance) during skill performance, as the extension is often used The complete shoulder joint, the elbow joint and the hip joint while maintaining a high position for (the center of gravity of the body) during the final hitting stage, and the player must issue a large central force to maintain the speed achieved in the racket and the continuation of the speed of the center of gravity of the body and the rest of the body at the speed of the possibility of performing the skill of serving.[10] All this helped make the change in the velocity of the body parts accused of performance, which is related to the amount of mass of this body or the mass of the body part and its speed between the grooming and hitting phases, which has to do with the form of pushing the instantaneous force exerted, as the momentary force is the reason for the change in the amount of movement of the body Always.[11]

Some researchers pointed out that training according to the moment of resistance and the absolute and relative muscle moments it encounters enhances the physical and mental ability of the player to visualize the required movement paths, which focus on taking appropriate positions that increase the angular and linear velocity of his body parts by reducing the radii during the performance to which he is exposed in Each repetition ,[12] and these repetitions worked to increase the absolute muscle strength of the muscles working in the performance of these stages and increase the efficiency of their neuromuscular compatibility and at appropriate times between repetitions, and all these exercises led to an improvement in the movement paths, especially at the moment of linking the preparation to strike The performance of the strike in the serving skill influences the correlation of the technical performance of the service, which inevitably affects the achievement of good performance, and there had to be iterations to train these parts of the basic skill in order to achieve the special speed and increase the feeling of effective hitting in order to develop the special mechanical variables for these stages which are linked Certainly of the previous stages, to ensure the achievement of the required speed for the body and the racket after launch. . As some studies indicate that there is an effect of training using assistive devices in improving efficiency on mastering skills and achieving movement paths for the center of gravity of the body in varying proportions to achieve the goal of training, in addition to that these methods give a positive opportunity to understand the components of skill performance and the possibility of applying it in practice and thus gives an effective effect on Raising the level of motor performance of skills .[13]

Some studies have indicated that all the characteristics of strength, speed, thrust and direction that a tennis player needs must be in harmony with the goal of performance and the final hitting stage, as the player can take the appropriate technical and mechanical positions due to its association with compound movements and exert the required force with the trunk and arms in a sequential and smooth manner.[14]

Table 2. Shows the measurements to respond to members of the sample time

Variables	Tests	Units	Mean	SD	Mean diff.	SD diff.	(t) value*	Moral level	Type of significance
Response time	Pre	Sec.	3.86	1.6	1.3	0.287	4.52	0.015	Sig.
	Post		2.56	1.9					

*Significance at ≤ 0.05 significance level.

The researcher attributes the reason for the development of the response time to that the exercises in which the sample members used resistors bound by rubber ropes along with the skillful performance and the use of the accompanying corrective feedback contributed to enhancing the attention to the visual stimulus (temporary arm movement), which contributed to the development of the sense of the field of travel distance of the body, the wheelchair, and parts The other body and I helped the players to achieve them in the appropriate manner for good technical performance in order to achieve the best movement response.[15]The researcher was keen to train the members of the sample to perform training while achieving the best angles in the parts of the body and developing the strengths of them in order to economize the momentary muscle strength and in the shortest possible time according to the skillful performance, which facilitated the application of the instantaneous force correctly, especially when starting the movement of the chair according to the correct direction to achieve the correct response that helps In taking the right and appropriate angles to continue this speed.[16]

The application of a good technique of forces to the parts of the body contributing to performance must be done with a balanced kinematic compatibility and high control, especially when extending the striking arm forward at the start of the serve, which comes simultaneously with the swinging arm backward. This means obtaining the mechanical mode that qualifies the player to perform better and good service. Therefore, the researcher was keen to train the members of the sample and train the working muscles of the parts of the body in order to enhance the instantaneous muscle strength in the least possible time according to the skill performance, which facilitated the correct application of the instantaneous force according to the specificity of the skill performance that expresses the final speed that the player reaches.[17]

The results indicated that the exercises that aimed to deepen the foundations of applying the correct movements and according to its technical path by using the development of muscle strengths in the joints (working) in the shoulders, hips and torso were for the development of the instantaneous rotational force of the shoulders, trunk and arms as they are responsible for the performance of the skill of sending and according to the angles The body and its change in the stages of the serve performance,[18] as it appears that the exercises with ropes according to the change of the arms of the resistance have led to the understanding and assimilation of the research sample the technical matters of the performance stages at the moment of hitting through the apparent improvement in the speed of the centers of the parts of this arm, and this improvement is a result of the strength and torque training of the arms and the torso This helped to overcome the mass of the body and the chair during the performance and what follows it from other technical stages, reaching the final stage of striking properly without a technical error, as the use of resistors with less than the maximum intensity when training leads to an increase in the momentary force and the emphasis on changing the tool blocks gives Positive in the acceleration of body parts and device development .[19] Therefore, all exercises aimed at developing muscle strength and momentum with the technical performance required and appropriate for it . This was also emphasized and followed up through the use of exercises using various training methods, and the correction of these values through training to identify possible errors and prepare the exercises according to the requirements of the results of the analysis.[20]

Conclusions

1. Training according to the results of the analysis and by using the change of resistance arms when training with rubber ropes was influential in developing the speed of the striking arm parts centers of the research sample.

2. The exercises led to an improvement in the technical performance coherence (the research sample), which inevitably affects the achievement of a good achievement.

3. The special exercises affected the improvement in the response time of the research sample.

Ethical Clearance: The Research Ethical Committee at scientific research by ethical approval of both MOH and MOHSER in Iraq

Conflict of Interest: None

Funding: Self-funding

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