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The effect of exercises with a designed device on the strength of the ankle joint ligaments for athletes injured with minor sprains

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Abstract---The purpose of this paper is to preparing exercises with a device designed to rehabilitate the strength of the ankle joint ligaments, and identifying the effect of exercise with a device designed to strengthen the ankle joint ligaments for athletes injured with minor sprains. The two researchers used the experimental method by designing the experimental group with a pre-and post-test in order to suit the problem in order to reach results that achieve the objectives of the research and its imposition. The research community was identified for athletes with minor sprains in the ankle joint in Baghdad Governorate, where the first injury was on 30/10/2020 and the injuries were at different times, which started from this date and the first injury occurred in the player during the exercise, and the injury was determined after the diagnosis by Doctor The specialist, when conducting a clinical examination and magnetic resonance imaging, it was found that they had a simple sprain in the ankle joint, which does not exceed a period of one to three days, which results in continuous pain in the ankle joint and limits movement, and their number reached (6) athletes homogeneous in the type of injury and the researchers chose them completely for the experiment, One of the most important results reached by the researcher is that: The rehabilitation exercises prepared by the two researchers using the water bike device by the members of the research sample have positively affected the kinetic range (upward, downward), and the rehabilitative exercises prepared by the two researchers using the water bike device by the research sample members had a positive effect on developing the muscular strength working for the directions (up and down) on the ankle joint. One of the most important

recommendations recommended by the researchers is that: Adoption of special exercises using the device designed to treat and rehabilitate the ankle joint has an impact on taking into account the muscle groups working on the joints of athletes, and necessity of paying attention to physical therapy and rehabilitation, forming a physiotherapy center, and educating students within the faculties of physical education and club athletes due to the necessity of avoiding and preventing sports injuries.

Keywords---exercises, strength, athletes injured, minor sprains.

Introduction

Most of the players are exposed to various sports injuries that stand in the way of developing their levels, so we find that these injuries are increasing with the increasing requirements for sports through increasing their loads, which is expressed through the increase in repetitions with high stress due to poor planning of training programs and inappropriateness of the components of the training load. With the ability of the athlete, all of which are factors that cause sports injury and are called training errors, and moving from one surface to another at different heights and medical installation causes injury. The return of the athlete to play after the injury without undergoing rehabilitation is a big mistake. The return of the athlete and his continuation in his training or competitive curriculum will lead to a doubling of the injury and the athlete may not feel pain despite the injury taking a new structural form and this leads to a chronic state of recurring injury.

Rehabilitative exercises in general and in the sports field in particular are one of the most effective means in rehabilitating the injured, as there are indications that these rehabilitative exercises lead to many effects on the athlete's body, including the speed of the drainage of blood pools, and the prevention of internal bleeding in the body. The joint, in addition to accelerating the recovery of the muscles and joints their functional potential and returning them to work well. An ankle sprain is one of the common injuries that many athletes are exposed to, as it is one of the most common injuries that must be taken care of, even if it is simple because the possibility of recurrence is great due to the movements performed by the athlete, which has an impact on the skill level and sports contribution and loss of time if it. We learned that the ankle joint plays a major role in bearing the heavy burden during the performance of various activities and skills, so a large proportion of the injury occurs in this important joint of the body, so we find it necessary to study and analyze it. The importance of the research comes in preparing exercises with a device designed to rehabilitate the strength of the ankle joint ligaments for athletes through simple sprains using a designed device that helps to strengthen the joint ligaments and because this device is easy to perform and a desire to not lead to pain and risks of use as a result of excessive use, in addition to that. A new modern rehabilitation method that always arouses the desire of the injured athlete to use it, which helps him to restore his position as soon as possible.

Research problem

The problem of the research lies in the researchers' observation of the prevalence of this injury and its frequent recurrence among athletes. The researchers also noted that the program followed in rehabilitation medicine takes a long period in the treatment and rehabilitation of injured athletes, in addition to its lack of special exercises for the ankle joint to develop the strength of the ankle joint ligaments and the lack of a specialized team. He supervises the process of implementing and following up the followed program, where the program is given to athletes by doctors in medical clinics and is applied qualitatively by the injured themselves, so the two researchers decided to design a rehabilitation device that helps strengthen the strength of the ligaments of the ankle joint through simple sprains, for a better treatment And faster recovery, which treats the injury in a few periods and also helps to restore the joint to work normally, so the researcher studied this problem and developed appropriate solutions for it through the preparation of rehabilitation exercises with a device designed based on sound scientific foundations, including some special exercises to rehabilitate the ankle sprain injury Ankle joint.

Research objective

- Preparing exercises with a device designed to rehabilitate the strength of the ankle joint ligaments.
- Identifying the effect of exercise with a device designed to strengthen the ankle joint ligaments for athletes with minor sprains.

Research hypotheses

There is an effect of exercises with a device designed to strengthen the ligaments of the ankle joint for athletes with minor sprains.

Research fields

- Human field: A sample of athletes with a simple sprain in the ankle joint.
- Time field: (17/11/2021) to (9/1/2022)
- Spatial field: Rehabilitation hall in the Directorate of Sports Medicine / Ministry of Youth and Sports / Baghdad.

Research Methodology and Field Procedures

Research Methodology

The two researchers used the experimental method by designing the experimental group with a pre-and post-test in order to suit the problem in order to reach results that achieve the objectives of the research and its imposition.

Table 1
Shows the experimental design of the research

group	Pre-test	Rehabilitation exercises	Post-test
first experimental group	Range of kinetic tests Ankle joint strength test	Rehabilitation exercises	nge of kinetic tests Ankle joint strength test

Community and sample research

The research community was identified for athletes with minor sprains in the ankle joint in Baghdad Governorate, where the first injury was on 30/10/2020 and the injuries were at different times, which started from this date and the first injury occurred in the player during the exercise, and the injury was determined after the diagnosis by Doctor The specialist, when conducting a clinical examination and magnetic resonance imaging, it was found that they had a simple sprain in the ankle joint, which does not exceed a period of one to three days, which results in continuous pain in the ankle joint and limits movement, and their number reached (6) athletes homogeneous in the type of injury and the researchers chose them completely For the experiment, the group and table (2) were qualified, showing the population and the research samples.

Table 2
Shows the population and all research samples

No.	Number of Athletes	Percentage
1	6	100%

Research tools and used devices: The researcher used the following means, tools and devices

- Arab and foreign sources.
- Observation and experimentation.
- Diagnostic tests, physical assessment and measurement.
- International information web .
- Results registration forms.
- Camera (canon) 6D.
- Discs (CD).
- DEEL laptop calculator, number (1).
- Medical bed.
- Sticky labels.
- Rehabilitation water bike device (designed device)

Field Research Procedures

Diagnosis and medical examination by the specialist (Riyad. 1999)

- Feel the muscles working on the ankle joint in search of painful points or places when pressure is applied.
- The doctor is looking for loss of feeling or weakness in the legs.
- Preparing a feedback form for each injured person to accompany him.
- Check the MRI.

At the beginning of the injury, a magnetic resonance imaging device (A.R.M) is used, as well as after recovery, because it is sufficient to discover the type of damage and the rate of recovery that occurs in the injury, according to studies on this subject, and that one of the most prominent reasons for using magnetic resonance because such an injury may lead to a rupture The ligaments surrounding the joint are therefore taken (A.R.M) rays, which have an effective role in the accurate diagnosis process. Through clinical examination and magnetic resonance imaging, the type of injury was determined, which is (a simple sprain).

Identify tests

The main objective of the tests is to identify the percentage of changes in the injury area before and after the rehabilitation program.

First: A test of the range of kinetic of the ankle joint: using an ankle sprain measurement device: Features and objectives of the ankle sprain measurement device.

- Measuring the severity of an ankle sprain.
- Measuring the level of pain when an ankle injury
- Measuring the vehicle through the vertical movement of the ankle joint.
- Measuring the degree of flexibility of the ankle joint at the maximum range of kinetic (flexion up, extension down, inward rotation, outward rotation)

How the device works

The device is placed on the ground. The laboratory rises on the device by placing the feet on both sides of the device, then moves the affected foot on the moving base to the right and left sides with complete freedom, and this base is installed on the iron lip in the middle of the device from its beginning to the end. The laboratory moves the affected foot to the right sides for if the foot is sprained, and if the left foot is to the left, the movement is to the left, and both movements (right - left) and in four directions is what is known as inverted sprains. During any movement of the ankle joint through the base connected from below, four helical springs, two of which are placed diagonally (1) in the upper corner from the right side and the second at the end of the base from the left side, their purpose is to give balance only to the base.

As for the remaining 6 springs, they are distributed under the movable base, every 3 on the side of these springs. Each one has a different height from the

other, weighted according to the angle of inclination of the ankle joint and according to the illumination of the lamp with the angle of inclination determined by the flexion of the ankle. The movement of the base was divided into three levels, each level (30) degrees, meaning that it works at three angles, from zero degrees to (30) is the first level, i.e. injury and pain of the third degree severe, and from (30) to (60) is the second level, i.e. injury and pain From the second (medium) degree and from (60) to (90) it is the third level, i.e. the injury and pain of the first (simple) degree so that the final result is at an angle of (90) degrees, which represents the complete flexibility of the ankle joint for a healthy person and there are between the three angles a minute or two Part of the range of kinetic of the ankle joint.

Applications

The device has been practically applied to athletes in Dhi Qar governorate who has sprained ankle

Recording

The angles are recorded in the directions after the test is performed for the injured player while he performs these movements to the maximum range of kinetic that the joint can reach without feeling pain. As for the degree of pain, it is determined through the reading, or the degree obtained by using the ankle sprain device if it is of the first mild degree, the second degree of the medium, or the third degree of severe.

Second: Ankle joint strength test: using a portable electronic scale portable electronic scale) for measuring muscle strength Specifications of the (portable electronic scale)

- Measures muscle strength.
- Measures muscle strength in newtons, kilograms and pounds.
- Measures pull force, push force and sides (inside and outside)

The aim of the test

Measuring muscle strength for a group of ankle muscles from:

- From the ankle extended position down.
- From the position of the ankle flexed upward.
- From the position of rotation inward
- From the rotate-out position

Tools used

A test chair, a lower ruler, a belt to stabilize the quadriceps muscle, an electronic scale, and a fixed, non-elastic band.

Performance description

The strength of the muscles and ligaments working on the ankle joint was measured through the player sitting on a chair with a height of (70) cm so that the feet are not touching the ground, the back is straight and the arms are in front of the body without support. The researcher begins by teaching the player the test technique where the player sits on the chair and performs The researcher installs the belt on the quadriceps muscle by means of supports on both sides of the chair, as well as fixing the non-rubber strap under the player's leg with the electronic scale by means of a ring installed under the chair.

Recording

Read the device and take the best reading.

Exploratory experience

The exploratory experiment was conducted on Sunday, November 21, 2021 at nine in the morning at the Teachers Center, where he was briefed on the devices that were identified through the Scientific Committee and through specialists and experts in the field of physical therapy and scientifically guaranteed. And getting to know the work of these devices through the number of sessions per week and the time of each session. The experiment was conducted at the time mentioned above on one of the athletes with a sprained ankle. Work was done on the devices and how to place the device on the affected area, as well as making sure of the efficiency of the force sensor device. To the therapeutic exercises room to clarify the exercises used in the program and how to apply them and how to perform some exercises and this was supervised by the two researchers.

Pre-tests

The researcher conducted the tribal tests as follows: Pre-tests were conducted for the research sample at the Teachers Center, noting that the tribal tests were on different dates, due to the lack of the sample in totals, but it came one by one, because the sample was from people with a simple sprain of the ankle joint and it is not easy to obtain it in one go, so the first test started My pre-test for diagnosis and physical evaluation of the research sample was on 28/11/2021, and the last pre-test was on Tuesday 30/11/2021 at the Teachers Center.

Implementation of the rehabilitation program vocabulary: the two researchers presented it to the experts, and it was revised and produced in its final form, which includes two parts (see appendix 1)

- The researchers took into account that the rehabilitation exercises should be modern, using the rehabilitation bike, and of a completely different nature from the usual exercises that are used inside treatment centers, in addition to the exercises. Physiotherapy methods and techniques were used before practicing the exercises for a sprained ankle.
- The duration of the implementation of the vocabulary of the rehabilitation program is (8) weeks.

- The two researchers took into account that the number of units should be (3) units per week, so the total number of units in the rehabilitation curriculum is (24) units.
- The principle of gradualism was taken into account in giving exercises from easy to difficult.
- The two researchers gradually increased the repetitions (3-10) times.
- The time of stability or performance of each exercise ranged (from 8 seconds - 30 seconds), and the two researchers took into account the gradation in the time of performance.
- The duration of the rehabilitation curriculum ranges from (60-75) minutes

Post-tests

The two researchers conducted post-tests as follows:- After completing 8 weeks for each injured, starting from the first day of the pre-test for the first injured on 23/1/2022 until 25/1/2022, which is the last test for the last injured, the two researchers conducted the post-tests under the same conditions and capabilities as the pre-tests. That is, consecutively, a specialist doctor examined them and a clinical examination was conducted, at the Teachers Center

Statistical methods

The search data was processed through the Statistical Package for the Social Sciences (SPSS).

Results and Discussion

Presentation and discussion of the results of the pre and post-tests of the ankle joint (injury area) for the variables under study. Presenting the results of the pre and post-tests to test the range of kinetic of the ankle joint (injury area) (at the maximum range of kinetic and strength of the ligaments) for the group members

Table 3
Shows the significance of the differences for the research sample in the first variable (maximum range of kinetic) for the pre and post-tests

No.	Variables	Measuring unit	experimental group pre		experimental group post		T value calculated	Level Sig	Type Sig
			Arithmetic mean	Standard deviation	Arithmetic mean	Standard deviation			
1	Maximum range of kinetic	Degree	62.23	0.796	76.62	0.772	76.04	0.000	Sig
2	Maximum range of kinetic downward	Degree	65.33	0.738	87.05	1.144	51.43	0.000	Sig
3	The amount of	Degree	25.08	0.383	46.57	0.985	56.11	0.000	Sig

	joint strength up								
4	The amount of joint strength down	Degree	37.96	0.455	66.67	0.991	55.88	0.000	Sig

Discussing the results of the pre and post-tests to test the range of kinetic of the ankle joint (injury area) (at the maximum range of kinetic and strength of the ligaments) for the research sample members

The results presented in Table (3) showed the values of arithmetic means, standard deviations, and (t) value of the kinetic range tests in the upward and downward bending kinetic (at the maximum range of kinetic and strength) for the existence of significant differences between the pre and post-tests of the two experimental groups and in favor of the post-tests, and the researchers attributed the reason for The presence of moral differences for the individuals of the research sample to the rehabilitation exercises prepared by the two researchers using the rehabilitation aid, the water bike, This is consistent with what was mentioned by "The aid has a positive effect on muscular strength because it adds resistance in all directions, which is positively reflected in improving muscular performance and strengthening joint ligaments" (Khalil. 1990). And " add that the aid develops the level of muscle strength and improves the level of muscle balance" (McNeely and David Sandler . 2006), In a study conducted by the researchers it was mentioned that "six weeks of exercises increase strength, increase muscle size, and also contribute to improving balance and fluidity of the muscles of the legs" (Webrighta & D.H. Pperrin. 2008) .The two researchers attribute the moral differences to the effect of the various standardized exercises that were used by the two researchers in rehabilitating and developing the research variables (the range of kinetic of the joint and the strength of the ligaments). Confirmed "the use of rehabilitation exercises using assistive devices contributes to the development and development of muscular strength" (Muhammad. 2010).

Conclusions and Recommendations

Conclusions

- The rehabilitation exercises prepared by the two researchers using the water bike device by the members of the research sample have positively affected the kinetic range (upward, downward).
- The rehabilitative exercises prepared by the two researchers using the water bike device by the research sample members had a positive effect on developing the muscular strength working for the directions (up and down) on the ankle joint.

Recommendations

- Adoption of special exercises using the device designed to treat and rehabilitate the ankle joint has an impact on taking into account the muscle groups working on the joints of athletes.
- Necessity of paying attention to physical therapy and rehabilitation, forming a physiotherapy center, and educating students within the faculties of physical education and club athletes due to the necessity of avoiding and preventing sports injuries.
- Dissemination of special exercises used by the people of physiotherapy in hospitals for performing them by the injured.
- Introducing the assistant medical staff working in the field of physical education and accompanying the national teams and sports clubs to the importance of integrating the therapeutic method and physical exercises during the rehabilitation period

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Appendix (1)

Therapeutic exercises

exercises	performance method
(1)	From a sitting position on the bike, the athlete rotates the bike by gently pressing the affected foot up and down alternately to the point of pain.
(2)	From a sitting position on the bike, the athlete raises the heels so that

	the pressure is on the toes by pressing and lifting with the other foot
(3)	From a standing position on two legs, then the athlete presses the two legs of the bike in succession, quickly and then slowly.

Appendix (2)

Shows the rehabilitation program

The importance of therapeutic exercises is highlighted through how to shape the load in proportion to the injury, as it is not subject to the laws of the formation of the pregnancy in terms of size, intensity and comfort. The goal and there are some physical attributes, we can extract size and intensity easily, such as strength and speed, through maximum resistance or maximum repetition or best achievement as in speed, but in lengthening and flexibility exercises it is difficult to extract maximum resistance or maximum repetition and in this case, it can be extracted in two ways, the first through time and these are useful in training, but in therapeutic exercises, we refer to the components of the ideal load formation for each physical characteristic, especially the lengthening, for example, intensity (100% or the maximum that the player can bear) repetition from (10-20 times) either performance time or stability (10-30 seconds). As for the number of training times during the week (3 days), the rest is completely positive or negative.

Appendix (3)

The first week (rehabilitation unit time 60-75 minutes), (rehabilitation exercises time 40 minutes), (physical therapy time 35 minutes)

No.	day	Unit	Exercise performance time	Repetition	Rest between repetitions	Sets	Rest between Sets	Total time
1	Sunday	(1)	1	15 sec	3-5	2	60 sec	1.30 min
			2	10 sec	3-5	2	60 sec	1.20 min
			3	12 sec	3-5	2	60 sec	1.24 min