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Research Article

The Effect of Rehabilitation Exercises in the Aquatic Environment on Some Motor Abilities of Athletes With Moderate Tear of the Internal Ankle Ligament

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Abstract: In general and in the sports field in particular, are one of the most effective means of rehabilitating injured people, as there are indications that these rehabilitative exercises lead to many effects in the athlete's body, including speeding up the drainage of blood collections and preventing internal bleeding in the joint, in addition to. Accelerating the recovery of muscles and joints to their functional potential and returning them to working well. Experimental method, designed with two equal ankle groups Introduction and research problem The sample number reached (8) players Rehabilitation exercises using water and rehabilitation exercises in water have a positive and effective effect in reducing the disappearance of pain for the two experimental groups. An athlete returning to play after an injury without undergoing rehabilitation is a big mistake. The athlete's return and continuation of his training or competitive program will lead to a doubling of the injury. The athlete may not feel pain even though the injury has taken a new, structural form, and this leads to a chronic condition of recurrence of the injury. Plain Language Summary Most players are exposed to various sports injuries that stand in the way of developing their levels. Therefore, we find that these injuries increase with the increase in sports requirements through increasing their loads, which is expressed through an increase in repetitions at high intensity due to poor planning of training programs and the lack of proportionality of the training load components with. The ability of the athlete, all of which are factors that cause sports injury, are called training errors.

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INTRODUCTION

Rehabilitation exercises in general and in the sports field in particular, are one of the most effective means of rehabilitating injured people[1], as there are indications that these rehabilitative exercises lead to many effects in the athlete's body, including speeding up the drainage of blood collections and preventing internal[2] bleeding in the joint, in addition to. Accelerating the recovery of muscles and joints to their functional potential and returning them to working well[3]. Through the researcher's field experience resulting from his work as a former medical therapist with the Al-Kifl Sports Club in

Babil Govern orate, as well as through the researcher's follow-up and observation, in addition to being a former football player[4], he noticed the spread of internal ankle ligament injuries among football players and the delay of most athletes in returning to the stadiums and restarting their lives[5]. The injury occurs again and turns it into a chronic injury. These pains increase in cases of flexion and extension of the ankle joint for any movement. Injury to the internal ligament of the ankle and the pain and suffering that the injured person suffers is represented by limited movement and disability[6]

Research Objectives:

- Identify the effect of rehabilitation exercises in the aquatic environment on some of the motor abilities of athletes with moderate tear of the internal ankle ligament

Research Hypotheses:

- Rehabilitation exercises in the aquatic environment have a positive effect on some of the motor abilities of athletes with moderate rupture of the internal ankle ligament

MATERIALS AND METHODS

The researcher used the experimental method and designed two equal groups, with a pre- and post-test, to suit the research problem. Below is the experimental design.

The Research Community and Its Sample: The research community was defined by players with moderate rupture of the internal ligament of the ankle[7]. They were chosen intentionally and their number reached[9] players, including them. They represent the Babylon football clubs for the excellent, first and second divisions. Then the research sample was selected intentionally from the research community and reached They number[8] players with a moderate tear of the internal ligament of the medial ankle of the right and left foot. They represent Babel Club, Al-Hilla Club, Al-Qasim Club, Al-Madhatiya Club, and Al-Kifl Club.

Homogeneity of the Research Sample: In order to verify that the research sample is distributed normally in the variables related to the research topic, which have a clear and direct impact on the validity and accuracy of the results, so the researcher conducted homogeneity in the variables (age, training age, time of injury).

Methods, Devices and Tools Used in the Research:

- Note
- The questionnaire
- Tests and measurement
- A goniometer device to measure the range of motion of the joint
- Medical scale of Chinese origin
- Hall, rugs, towels and pillows
- Rubber ropes
- Half a medicine ball
- Mobile camera
- Lenovo computer (Chinese origin)

Field Research Procedures: Conducting a comprehensive survey of a number of Babylon football club players to determine the number of players with moderate rupture of the internal ankle ligament. Obtaining the consent of the research sample to participate in the research. Conducting clinical examinations and taking X-rays of the research sample by specialized doctors[3], as the purpose of these examinations was to identify tissue changes and determine the type of injury. The selected measurements and tests were determined based on some scientific studies related to the research topic[1]. (pain degree scale, ankle range of motion test. The researcher, after consulting foreign scientific sources[1], conducted a procedure regarding dividing the angles of the natural range of motion of the ankle joint, as angles were formed for the vertical plane of flexion of the dorsum of the foot upward (10-30) and flexion of the sole of the foot downward (45-65) and the horizontal plane of flexion angles Inward medial (30-50) External lateral flexion (15-30)

Description and Identification of Special Measurements and Tests in the Research

Test to Measure the Degree of Pain: Through a special questionnaire designed by the researcher, this form included a set of tests related to the pain that members of the research sample suffer from and the test to measure pain ranges from (zero) to[10], with the number zero indicating the absence of pain and the number ten indicating the presence of no pain. The rest of the numbers may be divided into various levels of pain[2]:

Numbers from (0-2) indicate simple pain that does not hinder any daily activities, as the affected person can get used to it. Numbers[3,4] indicate supra scapular pain, as the affected person clearly feels the pain as if it were a sudden wound or a direct blow. Numbers [7,8]. At this

stage, pain dominates the injured person and the injured person faces extreme difficulty in managing his daily needs. Numbers[9,10]. Pain so severe that the sufferer will not be able to bear it, because it completely controls the affected person

- The patient chooses the degree of pain he is experiencing, and a test to measure the degree of pain is conducted at the end of each week over a period of six weeks to determine the extent of the decrease in the degree of pain

Test of Dorsi flexion of the Foot:[5]

- **Purpose of the Test:** To measure the range of motion of the ankle joint in the dorsal direction of the foot
- **Tools Used:** bed, goniometer, registration form, pen and paper
- **Test Description:** The tester sits on the bed, attaches the goniometer device to the tester's foot, and the tester extends the foot as far as possible until the onset of pain is felt and stability in this position

Plantar Flexion Test of the Foot:[6]

- **Purpose of the Test:** To measure the extent of the foot joint in the plantar direction of the foot
- **Tools Used:** goniometer, examination bed, pen and paper
- **Description of Performance:** The tester sits on the bed, attaches the goniometer to the tester's foot, and the tester bends the foot as low as possible until he feels the onset of pain and stability in this position[7].
- **Recording Method:** The angle achieved by the laboratory is recorded by reading the goniometer
- **Fourth:** Testing the medial flexion of the foot inward

- **Purpose of the Test:** to measure the extent of the foot's joint inward
- **Tools and Devices Used:** goniometer, registration form, bed
- **Performance Specifications:** The tester sits on the bed. The goniometer device is placed on the tester's foot. The tester turns the foot inward as far as possible until the onset of pain is felt and stability in this position
- **Recording Method:** The laboratory records the angle achieved by the laboratory by reading the device .

Test for Lateral Flexion of the Foot:

- **Purpose of the Test:** To measure the extent of the foot's joint outward. the laboratory by reading the device

The Qualifying Curriculum: The researcher began applying the proposed rehabilitative exercises by relying on some scientific sources[1] in the content of the rehabilitative curriculum and in selecting appropriate exercises for rehabilitating the injury of a moderate tear of the internal ankle ligament for soccer players. The researcher began using the rehabilitative exercises inside the aquatic environment and the repetitions were determined based on the ability to the injured person, by recording the number of total repetitions until he feels pain and the time period for the total repetitions was also recorded to benefit from it in knowing the time of each repetition. The median will be extracted to know the number of repetitions that the injured person starts with. The researcher adopted the injured person's feeling of fatigue as an indicator to determine the periods of rest.

- **Do Exercises[4] Days a Week.**
- **The Total Number of Rehabilitation Units is 24 Units.**

RESULTS AND DISCUSSIONS

Presentation and Analysis of the Results of the Pre- and Post-Tests for the First Experimental Group (the Aids Group):

The tabular t value is (2.30) at a degree of freedom[7] and a significance level of (05.0)

It is clear from (Table 4) that the mean of the experimental group in measuring the degree of pain in dorsi flexion of the foot in the pre-test was (7.60), with a standard deviation of (0.90) and in the post-test, the mean was (1.20), with a standard deviation of (0.44), and the t value was) The calculated value is (17.53), which is greater than the tabulated value of (2.30) at the degree of freedom[7] and with a significance level of (0.000), which is less than the significance level of (0.05). This means that the differences are significant between the results of the pre-test and the post-test and in favor of Al-Baadi. It appears from the same table that the mean of the group for the group in the variable measuring the degree of pain, plantar flexion of the foot, in the pre-test was (7.22) and its standard deviation was (1.01), while in the post-test the mean was (1.33) and its standard deviation was (0.50) and the value of The calculated (t) is (14.32), which is greater than the tabulated value of

Table 1. Shows the experimental design of the research

Groups	Measurements and post-tests	Experimental procedure	Measurements and pre-tests
Experimental group	Pain degree scale	(6) A week of rehabilitation exercises using assistive	Pain degree scale
The first	Ankle range of motion test	devices in the aquatic environment	Ankle range of motion test
the group	Apply the same tests above	(6) A week of auxiliary exercises	
Second experimental		in the aquatic environment	

Table 2. Show distribution of the research sample

The clubs	The research sample	Exploratory sample
Babylon	1	1
Hilla	1	1
Al-Qasim	1	0
Medhatia	2	0
Kifl	3	0
Total 5	8	2

Table 3. Show sample homogeneity

Variables	Measuring unit	The first experimental group		The second experimental group		Calculated F value	Statistical function
Chronological age	the month	s-	A	s-	A	1.345	Non-Sig.
Training age	the month	290,37	36.40	276.00	24.00	0.013	Non-Sig.
Injury time	Today	10.38	1.06	10.13	1.13	1.145	Non-Sig.
		8.50	1.41	8.37	1.18		

Table 4: shows the means, standard deviations, the calculated (t) value, and the statistical significance of the test (pre- and post-test) for the group of aids - the percentage of pain at the maximum angle

Variables	Measuring unit	Posttest		Pretest		(t) value*	Significance level	Statistical
Dorsiflexion of the foot		Mean	Std	Mean	Std			significance
Plantar inversion of the foot Sig.		7.60 0.000	0.90	1.20	0.44	17.53	0.000	Sig.
External anteversion of the foot	Degree	7.22	1.01	1.33	0.50	14.32	0.000	Sig.
Internal inversion of the foot		7.61	1.04	1.32	0.52	14.94	0.000	Sig.
		7.61	0.92	1.33	0.51	16.80		

Table 5. Show means, standard deviations, calculated (t) value, and statistical significance of the test (pre- and post-test) for the group of assistive devices - the percentage of range of motion at the maximum angle

Variables	Measuring unit	Posttest		Pretest		(t) value*	Significance level	statistical significance
		Mean	Std	Mean	Std			
Dorsiflexion of the foot	Degree	7.11	1.23	28.61	1.04	37.13-	0.000	Sig.
Plantar inversion of the foot		40.13	1.64	62.87	1.35	30.21-	0.000	Sig.
External anteversion of the foot		11.13	1.35	28.87	1.13	28.48-	0.000	Sig.
Internal inversion of the foot		26.63	1.19	47.87	1.55	30.74-	0.000	Sig.

(2.30) at the degree of freedom[7] and with a significance level of (0.000), which is <(0.05). This means that the differences are significant between the results of the pre-and post-test's for the mean of the experimental group in the variable measuring the degree of pain, external inversion of the foot, in the pre-test (7.61) and its standard deviation (1.04) and in the post-test, the mean was (1.32) and its standard deviation (0.52) and the calculated (t) value was (14.94). which is greater than the tabular value of (2.30) at the degree of freedom[7] and at a significance level of (0.000), which is less than The level of statistical significance is (0.05), which means that the differences are significant between the results of the pre- and post-tests. While the mean of the experimental group in the variable measuring the degree of pain, internal inversion of the foot in the pre-test was (7.61) and its standard deviation was (0.92) and in the post-test the mean was (1.33) and its standard deviation was (0.51) and the calculated (t) value was (16.80) which is greater than the tabular value of (2.14) at a degree of freedom[7] and at a significance level of (0.000), which is less than (0.05). This means that the differences are significant between the results of the pre-and post-tests

The tabular t value is (2.30) at a degree of freedom[7] and a significance level of (05.0)

It is clear from Table (5) that the mean of the experimental group in measuring the variable range of motion (dorsi flexion of the foot) in the pre-test was (7.11), with a standard deviation of (1.23) and in the post-test, the mean was (28.61), with a standard deviation of (1.04). The calculated t value was (-37.13), which is greater than the tabulated value of (2.14) at the degree of freedom[7] and with a significance level of (0.000), which is less than the level of statistical significance (0.05). This means that the differences are significant between The results of the pre-test and post-test are in favor of the post-measurement. It is clear from the same table that the mean of the first experimental group in measuring the range of motion variable (plantar flexion of the foot) in the pre-test was (40.13) and its standard deviation was (1.64), while in the post-test the mean was (62.87) and its standard

deviation was (1.35). The calculated (t) value was (-30.21), which is greater than the tabular value (2.14) at the degree of freedom[7] and with a significance level of (0.000), which is less than the statistical function (0.05). This means that the differences are significant between the test results. The pre and post, and in favor of the post. As for the mean of the experimental group in measuring the variable range of motion (external inversion of the foot) in the pre-test (11.13) and its standard deviation was (1.35) and in the post-test the mean was (28.87) and its standard deviation was (1.13) and the calculated (t) value was (28.48 -), which is greater than the tabular value (2.14) at the degree of freedom[7] and with a significance level of (0.000), which is less than the level of statistical significance (0.05). This means that the differences are significant between the results of the pre- and post-test and in favor of the post-test While the mean of the experimental group in measuring the variable range of motion (internal inversion of the foot) in the pre-test was (26.63) and its standard deviation was (1.19) and in the post-test the mean was (47.87) and its standard deviation was (1.55) and the value of (t) was (1.55). The calculated value is (-30.74), which is greater than the tabular value of (2.30) at the degree of freedom[7] and with a significance level of (0.000), which is less than the level of statistical function (0.05). This means that the differences are significant between the results of the pre- and post-test and in favor of the post-test.

It is clear from (Table 4) that there are statistically significant differences between the tabular t value is (2.30) at a degree of freedom (7) and a significance level of (05.0)pre- and post-measurements in the pain variable for the first experimental group, and in favor of the post-measurement in the pain degree variable, which indicates the positive effect of the rehabilitative approach used. This improvement is due to the change in the degree of pain in the post-measurement to the rehabilitative exercises using means. Assistance such as rubber bands of different resistances, a different balance board, half a resistant medicine ball, weights of different weights and medicine balls, which played a very significant role in reducing the degree of pain.

The use of rehabilitative exercises helps reduce the degree of pain as a result of these exercises providing different and multiple resistances along the movement path, which helped raise the injured person's muscular capabilities necessary to perform strength exercises and flexibility exercises. The credit for this is due to the use of rehabilitative exercises, which work to activate the cycle. Blood circulation, which has a positive effect on muscle physiology. These results are consistent with the findings of Oliveria (2) and Heather[8] and that the rehabilitation approach has a positive effect in measuring the degree of pain.

It is clear from (Table 5) that there are statistically significant differences between the pre-and post-measurements in the range of motion variable, and in favor of the post-measurement. The researcher attributes the reason for this to the positive impact of the rehabilitation approach through the use of auxiliary means, so that this led to the range of motion of the joint reaching its normal state and it was The normal ranges of movement are up from (10-30) degrees, down from (45-65) degrees, inward from (30-50) and outward from (30.15) degrees. This appeared in the post-test (final), where all the affected people were in normal condition. For the range of motion, this is due to the role of the water environment and the rehabilitation exercises, which led to the return of the joint to its natural flexibility, as "by increasing flexibility and stretching the elastic tissues beyond their natural limits and keeping them in this position for a few moments[11] and with the repetition of this process, the tissues adapt to their new limits and the more flexibility increases." The body has a reduced risk of being exposed to any injury or damage when playing any game or activity. Rather, this increases the level of skill performance[12].

This improvement in the post-measurement of the range of motion variable occurred in its three stages, as its first and second stages included various stretching exercises and its third stage included exercises of higher intensity, longer time, and more exercises than the first and second stages, which had a positive effect on increasing and developing the range of motion of the joint. All directions are almost like a healthy foot[13].

Samia Khalil mentions that hydrotherapy is used for multiple purposes and to rehabilitate many injuries, as it depends on exposing the affected area to batches of hot and cold water to stimulate blood circulation and improve range of motion[14], as these contrasting baths work to relax the affected area and work to reduce the burden imposed when performing Activities that involve bearing body weight on the ground, and work to reduce the risk of injury or its recurrence in the rehabilitation program[15].

CONCLUSIONS

In light of the statistical analysis and through presenting and discussing the results of the research sample, the researcher reached the following conclusions:

- Rehabilitation exercises using aids in water and

rehabilitation exercises without using aids in water have a positive and effective effect in reducing the disappearance of pain for the two experimental groups

- Rehabilitation exercises in the aquatic environment have a positive effect in rehabilitating the moderate tear injury of the internal ligament of the ankle, improving the range of motion angles and the strength of the affected ligaments (flexion, extension, outward and inward dimensions) and improving motor balance and agility
- Rehabilitation exercises using aids and rehabilitation exercises without the use of aids helped the player return to practicing his specialized activity in a short period of time and with high efficiency

Recommendations: In light of the objectives and hypotheses of the research and through the conclusions, the researcher recommends the following

- Focus on using rehabilitative exercises using aids in the aquatic environment within any program to rehabilitate moderate ankle ligament tears
- The necessity of using rehabilitation exercises within the middle because of their positive effect in rehabilitating the injury of the moderate tear of the ankle ligaments
- Paying attention to the rehabilitation period due to its great importance in restoring the recovery of the injured part and returning to the field

Ethical Considerations

Compliance With Ethical Guidelines:

The ethical approval was obtained from the Research Ethics Committee of the College of Health and Medical Technologies/ Kufa, Al-Furat Al-Awsat Technical University (2/10/2023).

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