

The Impact of a Rehabilitation Program on Meniscal Tear Injury in Athletes

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ABSTRACT

The significance of the research lies in the preparation of a rehabilitation program for meniscus tear injuries in affected athletes, which aims to rehabilitate athletes from injuries that hinder their performance in their specialized sports. The problem of the research is that most athletes do not properly treat meniscus tear injuries and there is a lack of studies addressing this type of injury, which leads to functional impairment in the knee joint performance, preventing the player from practicing their specialized sport. The researchers used the experimental method for its suitability to the nature of solving research problems. The research sample included ten athletes with meniscus tears, selected intentionally. The aim of the research is to identify the effect of a rehabilitation program on meniscus tear injuries in affected athletes. The most significant conclusions were a clear improvement in the research group variables when using the rehabilitation program. The main recommendations were to generalize the used rehabilitation program to rehabilitation and physiotherapy centers in hospitals to apply it to affected individuals.

1. Introduction

Research Introduction and Its Importance

One of the most significant physical and psychological impacts on a person is the injury that may occur due to sports or even in non-athletes such as housewives or factory workers. Injuries are not exclusive to athletes and represent a disruption and impairment of health due to severe and sudden mechanical, chemical, and physical influences. However, sports injuries are common among athletes due to the direct contact between players despite the benefits of physical exercises. The risk of sports injuries increases when individuals do not perform warm-up exercises appropriately for the sport they practice. Sports injuries have become a major concern for professionals in sports medicine, both medical and athletic. Knee and ankle injuries are the most common types of injuries in sports, with the knee being the most vulnerable in various sports activities, especially meniscus tears. This type of injury occurs due to incorrect landing while jumping, running with excessive force or for a long time without warming up, incorrect turning, or due to ankle instability. The human body is like a pyramid where the body mass is evenly distributed on both sides. Any imbalance in any lower limb leads to an imbalance in the upper limbs, causing a mechanical imbalance in the nerves due to the lack of balance between the sides of the body.

Research Problem

The return of an athlete to play after an injury without undergoing rehabilitation is a significant mistake. Returning to training or competition without proper rehabilitation will exacerbate the injury. Through the researchers' experience in the sports field, they found that most athletes do not properly treat meniscus tear injuries, and there is a lack of studies addressing this type of injury. Meniscus tear injuries lead to functional impairment in knee joint performance, preventing the player from practicing their specialized sport. Therefore, the researchers aimed to highlight this problem and develop a scientifically studied rehabilitation program to solve it.

Research Objectives

To develop a rehabilitation program for meniscus tear injuries in affected athletes.

To identify the effect of the rehabilitation program on meniscus tear injuries in affected athletes.

Research Hypotheses

There are statistically significant differences between pre-tests and post-tests for athletes with meniscus tears, favoring the post-test.

Research Domains

Human Domain

Athletes with meniscus tears in Thi Qar Governorate.

Temporal Domain

From 28/8/2023 to 24/4/2024.

Spatial Domain

The gym.

Research Methodology and Field Procedures

Research Method

The researchers used the experimental method, which is the most suitable for the research objectives and hypotheses.

Table 1. illustrates the experimental design adopted in the research sample.

Group	Pre-Tests	Main Experiment	Post-Tests
Experimental Group	Physical Fitness Test for Injured Individuals	Implementation of Rehabilitation Program	Physical Fitness Test for Injured Individuals

Research Population and Sample

The sample was intentionally selected from individuals with meniscus tears. The researchers conducted a comprehensive field survey of clubs in Thi Qar Governorate for individual and team sports. They obtained ten players, who were selected as the research sample after being examined by a specialist doctor for medical evaluation. Through clinical medical examination for the initial diagnosis of the injury type, it was confirmed that they had meniscus tears. The rehabilitation program was then applied to them and they were treated based on scientifically accurate principles.

2.2.1 Sample Homogeneity

The researcher conducted a homogeneity process for the research sample in the required variables, which are height, weight, age, and training age, as shown in the following table:

Table 2. illustrates the homogeneity among the required variables.

#	Variables	Mean	Standard Deviation	Variability Coefficient
1	Length / cm	178	5,8	3,25
2	Weight / kg	72	9,3	12
3	Age / years	27	4,5	16
4	Training Age / years	15	3,6	5,5

Instruments and Methods of Data Collection

Instruments and Tools Used

Elastic bands

Weights of various sizes

Leg measurement device

Half ball

Goniometer

Stopwatch

Measuring tape

Methods of Data Collection

Arabic sources and references

Questionnaire

Personal interviews

Data recording form

Internet resources

Field Research Procedures

Specialist Doctor Examination

The injury was diagnosed by the specialist doctor through clinical examination and MRI. The clinical examination showed several signs in the injured individuals, including:

Pain in the affected area

Weakness in extending and flexing the knee

Weakness in moving the ankle in different directions

Poor performance in the tests given by the doctor

Through this examination, the sample was diagnosed with meniscus tears. After completing the rehabilitation program prepared by the researchers, the injured individuals were examined again by the specialist doctor, and the examination showed an improvement in their condition.

Tests Used in the Research

The researchers proposed and determined physical ability tests:

First: Measuring the range of motion of the knee (Riyadh Hassan Saleh Al-Zalmi, 2018)

Tests Used in the Research

First: Measuring the Range of Motion of the Knee Joint

The range of motion of the knee joint is tested by measuring the joint angles using a goniometer. This device is designed to measure the desired angles with different readings that suit the nature of the sample individuals.

Test Objective Measure the angles (range of motion) of knee extension and flexion.

Tools Used: Goniometer, suitable bench.

Performance Specifications: The injured person performs the test in the direction of flexion and extension to measure the range of motion of the knee joint in both directions (extension and flexion).

After that, the examiner places the subject in a prone position and fixes the goniometer so that the angle between the leg joint and the thigh is 90°. Then the subject moves the joint in both directions (flexion and extension) and the angles are recorded.

Recording Method The angles in both directions (flexion and extension) of the knee joint are recorded after fixing the arms of the goniometer to the maximum range of motion the joint can reach without pain.

Second: Measuring Thigh Circumference

Purpose of the Measurement: Measure the thigh circumference of the injured leg.

Tools Used: Measuring tape.

Performance Description: The injured athlete stands upright, then the total circumference of the injured leg is measured using a measuring tape.

Recording Method: Reading the measurement from the tape.

Third: Muscle Strength Tests for the Knee Joint

Endurance Strength

Purpose of the Test: Measure the endurance strength of the muscles working on the knee joint.

Tools Used: Stopwatch, recording sheets.

Performance Description: The injured person sits with their back against the wall, ensuring the back is in contact with the wall, and raises one leg about 5 cm off the ground for as long as possible without pain.

Recording Method: The time is recorded using a stopwatch from the moment the foot is raised until it is lowered by the subject.

(Speed-Specific Strength (Noor Khudair Ghazi, 2023

Purpose of the Test: Measure the speed-specific strength of the muscles working on the knee joint.

Tools Used: Leg curl machine (front and back), stopwatch, recording sheets.

Performance Description: The subject sits on the machine and flexes and extends the injured leg, then the healthy leg, alternating quickly between the front and back directions for 10 seconds.

Recording Method: Count the number of flexion and extension repetitions performed by the subject in the required time, which is 10 seconds.

Fourth: Static Muscle Balance for the Legs

Purpose of the Test: Measure the muscle balance of the leg muscles.

Tools Used: Stopwatch, recording sheets.

Performance Description: The examiner stands on the injured leg and places the healthy leg's foot on the middle of the injured leg, forming the letter P, with arms crossed over the chest in an X shape, maintaining balance for as long as possible without pain.

Recording Method: The time is recorded using a stopwatch from the moment the foot is lifted until the subject loses balance.

Fifth: Dynamic Muscle Balance for the Legs

Purpose of the Test: Measure the dynamic balance of the leg muscles.

Tools Used: Half ball, stick, stopwatch, recording sheets.

Performance Description: The examiner stands on the injured leg with a slight knee bend on the inverted half ball, lifts the healthy leg with a knee bend backward, holds the stick parallel to the body, and maintains balance for as long as possible without pain.

Recording Method: The time is recorded using a stopwatch from the moment the subject stands balanced on the inverted half ball until balance is lost.

Main Experiment Procedures

Pre-tests

The researchers conducted the pre-tests on the research sample of 10 athletes on Friday, October 13, 2023, at 3 PM in the Gym.

Implementation of the Rehabilitation Curriculum

After reviewing numerous Arabic and foreign scientific papers, theses, research studies, and expert opinions, as well as conducting personal interviews with experts and specialists, the researchers prepared physical exercises specifically for rehabilitating meniscus tear injuries. These exercises were applied to the injured individuals for a duration of three months, with three units per week. The aim of these exercises is to improve knee condition, develop strength, and attempt to restore normal movement. The rehabilitation curriculum included 43 exercises distributed across 36 units, following a progressive approach in physical load intensity and exercise difficulty.

The researchers took into account the use of pain as an indicator to stop exercising, where in the first month they used easy exercises performed only by the injured person, such as bodyweight resistance and using elastic bands, to improve range of motion, enhance flexibility, and strengthen muscle-bound ligaments, with a total of 8 exercises per unit. They increased exercise intensity in the last week to prepare for the second month, using more challenging exercises to increase leg muscle strength, improve meniscus condition, and strengthen associated muscles, with 6 exercises per unit, increasing intensity in the final week.

In the third month, the researchers began using highly intense and challenging exercises with varying weights to improve leg muscle balance, significantly improve knee joint function, with 5 exercises per unit. In the last two weeks, they incorporated exercises related to each individual's specific skills to prepare the injured individuals for returning to play areas .

Post-Intervention Tests and Measurements

After completing the rehabilitation program, post-intervention tests were conducted on the research sample on Friday, April 19, 2024, at 3:00 PM in the Iron Hall.

Statistical Methods

The researcher used statistical methods in the Statistical Package for the Social Sciences (SPSS) to perform statistical processing and select suitable procedures for the research.

Presentation, Analysis, and Discussion of Results

Presentation and discussion of pre-intervention and post-intervention measurements for physical variables.

Table 3. shows the arithmetic means, standard deviations, calculated (t) values, and significance level (p-value) for the group (pre-test - post-test) before and after.

:Variables	Pre-test for the Group		Post-test for the Group		Calculated (t) Value	Significance Level	Significance
	Mean	Standard Deviation	Mean	Standard Deviation			
Knee Extension	134.0000	9.61769	171.0000	4.18330	8.488	0.000	Significant
Knee Flexion	100.0000	15.81139	68.0000	9.08295	9.436	0.001	Significant
Right Thigh Circumference	36.2000	3.42053	41.2000	3.34664	25.298	0.000	Significant
Left Thigh Circumference	41.4000	3.84708	44.654	3.342	5.986	0.000	Significant

Based on the statistical study conducted and as shown in the tables above, there are significant differences between the pre-intervention test for the group and the post-intervention test for each of the knee range of motion variables (extension, flexion) and thigh circumference, in favor of the post-intervention test. The researchers attribute the reason for these differences in the post-intervention test to the exercises used in the rehabilitation program, where they utilized body weight exercises and exercises with elastic bands aimed at developing and improving knee range of motion. These exercises work to increase the flexibility of the ligaments and tendons surrounding the knee and increase the strength of the muscles working on it, resulting in a greater range of motion for the knee, as indicated by the statistics in the table above.

The mean for the pre-intervention test for knee extension was 134.0000, while the mean for the post-intervention test for knee extension was 171.0000, showing a clear difference in the ability to fully extend the knee after using the rehabilitation exercises. These exercises also work to improve knee joint movement and reduce knee joint stiffness, which helped improve knee flexion, as indicated by the statistics in the table above. The mean for the pre-intervention test for knee flexion was 100.0000, while the mean for the post-intervention test for knee flexion was 68.0000, showing a clear difference in the ability to flex the knee after using the rehabilitation exercises. As for the thigh circumference variable, muscle mass was built for the affected right leg through resistance exercises and physical exercises using different weights aimed at developing muscle mass to equalize the muscle mass of the affected right leg with that of the healthy left leg to achieve balance between the legs. This was evident in the statistics in the table above. The mean for the pre-intervention test for right thigh circumference was 36.2000, while the mean for the post-intervention test for right thigh circumference was 41.2000. The mean for the pre-intervention test for left thigh circumference was 41.4000, while the mean for the post-intervention test for left thigh circumference was 44.654, showing a clear improvement in muscle mass for the circumference of the affected leg.

Table 4. shows the arithmetic means, standard deviations, calculated (t) values, and significance level for muscle balance (pre-test - post-test) for the group.

Variables	Pre-test for the Group		Post-test for the Group		Calculated (t) Value	Significance Level	Significance
	Mean	Standard Deviation	Mean	Standard Deviation			
Static Balance Right	12.8	2.58844	17.8	2.58844	6.975	0.000	Significant
Static Balance Left	31.6	2.07364	34.6	2.07364	4.809	0.001	Significant
Dynamic Balance Right	9	2.23607	16	2.23607	7.934	0.000	Significant
Dynamic Balance Left	22.8	3.11448	26.8	3.11448	3.341	0.021	Significant

Based on the statistical study conducted and as shown in the tables above, there are significant differences between the pre-intervention test for the group and the post-intervention test for each of the static and dynamic balance variables, in favor of the post-intervention test. The researchers attribute the reason for these differences in the post-intervention test to the exercises used in the rehabilitation program, where they used specific balance exercises using some balance tools and physical exercises with different weights aimed at developing body balance during movement and stability. These exercises elevate the function of all leg joints such as the ankle joint, which is the primary joint in body balance. Since the body is a pyramid shape and body mass is evenly distributed on both sides, any imbalance in the lower extremities results in dysfunction in the upper extremities, meaning there is no balance between the sides of the body, leading to dysfunction in other leg joints like the knee joint. Additionally, these exercises work on developing the muscles of the legs and the ligaments and tendons, resulting in the injured party regaining previous muscle balance. This was evident in the statistics in the table above. The mean for the pre-intervention test for static balance of the right leg (the injured leg) was 12.8, while the mean for the post-intervention test for static balance of the right leg was 17.8. The mean for the pre-intervention test for static balance of the left leg was 31.6, while the mean for the post-intervention test for static balance of the left leg was 34.6. The mean for the pre-intervention test for dynamic balance of the right leg was 9, while the mean for the post-intervention test for dynamic balance of the right leg was 16. The mean for the pre-intervention test for dynamic balance of the left leg was 22.8, while the mean for the post-intervention test for dynamic balance of the left leg was 26.8, showing a clear improvement in muscle balance for both legs.

Conclusions:

Through the objectives and hypotheses set for the research, within the limits of the research sample, procedures, results, and statistical data processing for the studied variables, the researcher reached the following conclusions:

The rehabilitation exercises had a positive impact on knee joint rehabilitation.

A clear improvement occurred in the research group in the studied variables when using the rehabilitation approach

The rehabilitation exercises used led to improvement in knee range of motion and muscle balance of the legs.

Recommendations

Based on the conclusions reached by the researcher, the following recommendations are made: Generalize the rehabilitation approach used to rehabilitation and physiotherapy centers in hospitals for application to patients. Emphasize that rehabilitation programs should include exercises with a range of motion similar to the anatomical structure of the joint, which helps accelerate injury recovery. Utilize the results obtained when developing rehabilitation programs to expedite the treatment and rehabilitation of athletes after injury.

Sources

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