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The Effect of Therapeutic Exercises on the Rehabilitation of Partial Achilles Tendon Rupture in the Ankle Joint Among Football Players

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Abstract

The participation in the rehabilitation of injuries among athletes and non-athletes from various sports, as well as the prevention and reduction of sports injuries and the restoration of athletes to their pre-injury condition, represent a fundamental goal in the sports field. Progressive rehabilitative exercises, applied from simple to complex, play a crucial role in restoring function and reducing pain among injured athletes. This study aimed to design and implement rehabilitation sessions composed of targeted exercises to treat partial Achilles' tendon rupture in football players and to examine the differences between pre- and post-tests in static strength and balance. Using an experimental one-group pre–post design, the researcher applied the program to five football players aged 20–23 years, ensuring all exercises were performed correctly within the planned schedule. The results indicated that the rehabilitative exercises had a positive effect on balance and the studied physical attributes, enabling the players to return safely to play and competition. The study recommends adopting the proposed rehabilitation approach and emphasizes the importance of early treatment and rehabilitation of Achilles tendon injuries among football players.

Keywords: Football, Achilles Tendon, Ankle Joint.

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Introduction

Football is a dynamic sport typified by rapidly changing patterns of activity and offensive-defensive technical processes. Their successful performance depends on the physical and technical effort of the player during play. The game of handball is characterised by sharp sprints, quickly changing from one attacking activity to the next and therefore results in high physical demands on players during matches and training. Since players use their feet to push themselves, move forwards, sideways or backwards while doing skills and to shift from defense to offense it puts a tremendous amount of stress on the muscles and joints in that area which consequently causes leg pain.

Although great improvements have been made in sports injury medicine and the introduction of preventive procedures, there is still an excessive prevalence of sport-related injuries. The tendency that you don't spend endlessly amounts of energy during friendly environment like in ATP Cup -you do it to get higher ranking- with this competition, and the growing desire to show off who can push harder among players I guess. Sports-related injuries are an important challenge as they interfere with training and recovery program, thereby limiting the athletes' ability to achieve peak performance state. Partial rupture of the Achilles tendon at the ankle joint is common in football because most training loads and physical stress are concentrated to the foot.

As stated by Francis John (2001), through an accurate diagnosis and sport-specific rehabilitation programs, the match fitness can be achieved faster, and earlier return to baseline level of performance is sustained. Appropriate post injury rehabilitation is the key to regaining as much of the full function of the injured site and in as short time period as possible.

The scientific and practical significance of this research lies in developing rehabilitative exercises aimed at improving the static strength of the flexor and extensor muscles, enhancing balance and other physical attributes, and determining the impact of these exercises on the recovery of partial Achilles tendon rupture in the ankle joint.

Rehabilitative exercises represent one of the most essential scientific areas in physical education and sports sciences, particularly in restoring injured athletes to their pre-injury condition in the shortest time possible. Through the researcher's experience in the sports field, collaboration with physical therapy clinics, and review of related studies, a gap was identified — many rehabilitation programs for Achilles tendon rupture focus only on the initial recovery stage. Therefore, this study aims to design a comprehensive rehabilitative and physical exercise program

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emphasizing strength and balance training from the early stages of injury until full return to play and competition.

Research Objectives

- To design rehabilitative exercises for partial Achilles' tendon rupture in the ankle joint among football players.
- To identify significant differences between pre- and post-tests in static strength and balance among football players.

Research Hypotheses

- There are no statistically significant differences between pre- and post-tests in balance variables related to partial Achilles tendon rupture of the ankle joint among football players, in favor of the post-test.
- There are no statistically significant differences between pre- and post-tests in static strength variables related to partial Achilles tendon rupture of the ankle joint among football players, in favor of the post-test.

Research Fields

- **Human Field:** Football players suffering from partial Achilles tendon rupture in the ankle joint, aged 20–23 years.
- **Time Field:** From February 1, 2024 **to** April 15, 2024.
- **Place Field:** Medical Rehabilitation Center, New Baghdad – Baghdad

Methodology

The researcher employed the experimental method with a single-group pre–post design, as it is suitable for the nature of the study problem and enables the achievement of the research objectives and their alignment with the study's focus.

Research Sample

The research population consisted of 12 football players from first-division clubs, aged 20–23 years, who suffered from partial Achilles tendon rupture in the ankle joint in Baghdad. They visited rehabilitation centers between the first and second months of 2024 to provide personal information and injury-related data, including the date, type, and severity of the injury, as diagnosed by a specialized physician. The experiment was conducted individually on 5 injured players, who were deliberately selected as the research sample. Four injured players did not

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participate, and three were excluded due to non-compliance, leaving 5 players who met the required conditions and expressed willingness to participate in the rehabilitation exercises, adhering to the researcher's instructions and guidance.

Equipment and Tools Used

The measuring instruments used in the study were one Sony video camera, one Compex electrical stimulation equipment, one computer MacBook Air, a dynamometer made in Japan for measuring of muscle strength (Mauch), an electronic timing gate, two Mar Times digital stopwatches, a tape measure (metric), an Agme whistle five balls football standard size, five rubber bands of different colors and degrees of movement amplitude described by their manufacturers, eight cones or markers with various colors (Plasther) four ladders agility type "net", four stability balls of different sizes to do exercises sitting on them two mats outlet and pain scale.

Physical Tests

Physical examinations comprised three tests. The first one , the balance measure (Hassanein, 1996) was used to assess the stability of the player. The injured player keeps the foot of his affected leg on the ground and places his sound leg on top of the injured one while putting both hands in the middle. At the sound of the whistle, the player raised their heel off ground as high as possible and tried to hold this position without lifting up their forefoot. The test was repeated three times and best trial was used. Second, the static strength of the ankle flexor muscles (Hassanein, 1996) sought to measure it using a dynamometer, data form and pen. The player was seated on the floor with extended legs and holding the ground with hands, and his ankle was flexed slowly forward until pain appeared. Up to two trials were performed and the force was measured in kilograms. Third, static ankle extensor muscle strength (Fermat, 2012) To measure the static muscle force of ankle extensors using a dynamometer and data form as pen. Subjects were seated on the floor with knees extended and held the ground with both hands, which is where we steadied the strap of the dynamometer over that portion foot. The player slowly pushed out the ankle against the strap until their limits of resistance were achieved. Three trials were conducted and the best score, in kilograms, was noted.

Pilot Experiment

The researcher carried out a pilot study on two football players (Achilles tendon ruptures) not being part of the main sample. This experiment was performed on Thursday, February 10th, 2024 at 4:00 PM in the Medical Rehabilitation Center of New Baghdad. Aims of the trail: Identify

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limitations and challenges that the researcher might face, check function, equipment functionality and efficacy for appliances in use; test effectiveness of the auxiliary crew.

Pre-Test

After having selected the sample of the research by medical examination, and verified the type and location of injury for all players using an imaging (X-rays) done in collaboration with a specialist doctor to ensure that they were cleared to play sports again without hesitation, The researcher made pre-tests on the research sample on Saturday Feb 13, 2024 at Al-Zahraa Medical Rehabilitation Center in New Baghdad.

Rehabilitation Program

The therapeutic exercises were designed carefully according to the best available evidence, previous work, and expert opinion in sports rehabilitation and psychical education. Advice on the content of the program and number and length of rehabilitation units was also sought from sports medicine and orthopaedic experts. Rehabilitation after an Achilles tendon rupture in football The rehabilitation of Our football players after a ruptured Achilles tendon consisted of three phases.

Static, nonresistive exercises were the focus of phase one that attempted to decrease swelling and pain. This rehabilitation phase consisted in home exercises and ice application 4–5 times a day for 15 minutes with rest, without weight-bearing activities. Eight rehabilitation units were taught over a 2-week period.

Phase two focused on improving balance and ankle joint stabilization, as well as strength of the muscles around the ankle. This phase consisted of 4 training sessions per week with a duration of 45–50 min each (12 sessions in total over the course of 3 weeks inside the gym). It also included balance and static muscle strength for ankle flexion and extension as pre-tests.

The final phase, three weeks in duration focused on general conditioning and began training the total athlete including endurance, strength, groundwork (foundations), explosive power and on-field conditioning followed by 12 practice sessions. Physical examination, for evaluating progress was performed at the beginning of this phase. The rehabilitation program lasted 8 weeks in total.

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Post-Test

Upon finishing the eight weeks rehabilitation programmed, post-tests were conducted on Sunday April 7 th, 2024 by the researcher to control time, place equipment's and supporting staff in a manner that he could obtain reliable and comparable results to those of pre-test.

Statistical Analysis

The researcher analyzed the data statistically using the SPSS software, employing the following statistical analyses: standard deviation, arithmetic mean, paired-sample t-test, and differences between arithmetic means.

Results

Table 1. *shows the differences in arithmetic means and standard deviations between the pre-test and post-test for the studied variables.*

Variables	Test	Mean	Sample Size	Std. Deviation	Std. Error
Ankle Flexor Muscle Strength	Pre-test	7.0000	5	1.58114	0.70711
	Post-test	26.0000	5	3.67423	1.64317
Ankle Extensor Muscle Strength	Pre-test	6.8000	5	1.09545	0.48990
	Post-test	25.8000	5	1.78885	0.80000
Balance	Pre-test	15.0000	5	1.87083	0.83666
	Post-test	49.2000	5	1.92354	0.86023

Table 2. *shows the calculated t-values between the pre-test and post-test for the research sample*

Variables	Comparison	Mean Difference	Std. Deviation	t-value	df	Sig
Ankle Flexor Muscle Strength	Pre vs. Post	-19.00000	1.09545	17.345	4	0.000
Ankle Extensor Muscle Strength	Pre vs. Post	-19.00000	0.54772	34.689	4	0.000
Balance	Pre vs. Post	-34.20000	1.35647	25.213	4	0.000

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Discussion

Based on Tables (1) and (2), the researcher attributes the statistically significant improvements in the pre- and post-tests for the physical variable balance to the post-test results of the research sample. According to FIFA (2016), balance is defined as the athlete's ability to maintain the body in a specific position even under challenging conditions or to quickly restore equilibrium after a disturbance. The designed rehabilitation exercises and the variety of balance training methods for the injured, including exercises on stable surfaces such as standing on one leg with hands at the center or extended sideways, progressing to unstable surfaces like standing on a half-balance ball, aimed to enhance the function of sensory systems, including the visual system, internal sensory receptors, and proprioceptors located in ligaments, muscles, tendons, and joints. This aligns with Haider Abdulqader Nima (2019), who emphasized that balance exercises target multiple sensory systems simultaneously rather than a single sensory system.

Likewise, the significant improvements in ankle joint flexor and extensor muscle strength recorded during post-tests are attributed by the researcher to exercises applied. The 'rehabilitation program' aimed to improve the static muscle strength and balance with the flexible solidify of the ligament, peritinom, and muscles around to ankle joint through three types of training applied according to its each interval. Phase 1 adopted isometric exercises (i.e., static contraction of muscle) that Amr Allah Al-Bassati (2015) stated are conducive for muscle strength without the need to possess a variety of tools and equipment. Phil (2014) also stated that isometric exercises are excellent for strengthening ligaments, muscles, and tendons without causing the joint to be stressed. The researcher implemented this technique in multiple repeated sets with light resistance, and worked up to more that were increasingly advanced as the player's condition improved.

In phase two, isotonic exercises including squats and box jumps were performed to develop explosive power and speed-strength qualities. Bastowisi (2014) agreed that isotonic movements, where the muscle contracts and relaxes with movement produces superior effects on strength speed, 368 while also improves other motor abilities (Ahmed, 2014).

The rehabilitation was also basis on plyometric training. Allman (2012) shows that plyometric exercises such as jump drills improve running mechanics and reinforce the leg and upper body musculature. Also, ankle bounce training strengthens the ligaments and tendons. This idea is also supported by Kharbeit & Osman (2023) in that the action of the muscles as a stretch-shortening cycle. Muscles lengthen under tension and then concentrically contract during landing in this cycle, which is characteristic of plyometric exercise.

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Overall, the researcher emphasized that plyometric training is crucial for developing muscle strength and applied this principle in rehabilitating partial Achilles tendon rupture in the ankle joint.

Conclusions

the sample, goals, hypotheses and objectives of analysis carried out about the studied variables extracted from this research, the main conclusions can be established as follows: A training program had a significant effect in Treatment for functional capacity restoration of Achilles tendon at ankle joint. The results of our exercises were significant for balance and the static strength of ankle flexor and extensor muscles. A positive effect on balance improvement was found for the baseline intensity of activities maintaining a stable posture without movement when performed on a stable surface. Also, the researcher's interventions with respect to all physical variables isometric training in early rehabilitation isotonic and co-contracted muscle activities afterwards reported significant effects on promoting these physical qualities in women.

Recommendations

The suggestions of the study are: priority given to static strength exercises in the early stage of rehabilitation, training all methods for rehabilitation planned simultaneously by a specialized practitioner in order to improve physical variables and focus on dynamic balance exercises that had an important role in getting better results in study sample and determination of other studies aiming at the Achilles tendon rehabilitation at ankle joint.

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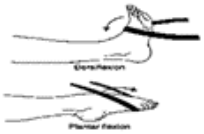
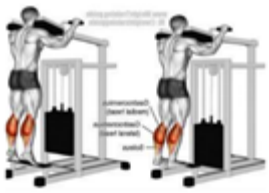
Appendices

Appendix 1. shows a sample rehabilitation unit for Achilles tendon rupture, with a duration of 60–90 minutes.

Objective: Rehabilitation unit focusing on balance and muscle strengthening
Week: 7, Day: 2

No	Exercise	Exercise Form	Purpose	Duration	Repetitions	Rest	Sets	Notes
1	Standing on one leg		Improve balance	20 sec	10–12	1–2 min	3–4	–
2	Hip abduction and adduction using a cable		Strengthen adductor and abductor muscles	–	10–12	2–3 min	3–4	–
3	Long sitting with ankle movements forward and backward		Strengthen leg muscles	–	10–12	1 min	3–4	–
4	Standing calf raises		Strengthen calf muscles	–	10–12	1–2 min	3–4	

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