



The Effect of a Rehabilitation Program Supported by TAE-BO Exercises on Certain Coordinative Abilities Among Tennis Players with Ankle Ligament Tears

Mustafa Muhammad Ali Farhan ¹

¹ University of Wasit , College of Physical Education and Sports Sciences .

DOI:

[https://doi.org/10.37359/JOPE.V38\(3\)2026.2425](https://doi.org/10.37359/JOPE.V38(3)2026.2425)

<https://creativecommons.org/licenses/by/4.0/>

Article history: Received 2/February/2026; Accepted 22/February/2026; Available online 28/September/2026

Abstract

The present study aims to design a rehabilitation program using modern techniques, namely Tae-Bo exercise, to explore its effects on some coordinative skills and ankle ligament tear rehabilitation. The researcher assumes that there are statistically significant differences in favor of the post-test. The experimental method using a single-group pre-test and post-test design was used because of its appropriateness to the research problem. The study population includes tennis players in Karbala clubs with ankle ligament tears. A sample of (4) injured players was chosen after professional medical assessment. The research variables were identified after a comprehensive search through scientific literature. In collaboration with his expertise, the researcher chose the relevant tests for the variables, carried out a pilot study on two subjects, and completed pre-tests following all formal procedures. The main experiment continued for (8) weeks, including Tae-Bo exercises in three rehabilitation units per week, each lasting (45) minutes. After the experiment, post-tests were conducted, and data were collected and organized in statistical tables for analysis and discussion. The results reveal statistically significant differences in favor of the post-test, reflecting a significant improvement after applying the rehabilitation program. Nevertheless, there is a need for further studies using a control group design to validate causal associations. The researcher suggests combining these exercises with mechanical modalities for the rehabilitation of other injuries.

Keywords: Rehabilitation Program, Tae-Bo Exercises, Coordinative Abilities.

¹ University of Wasit , College of Physical Education and Sports Sciences .
mmali@uowasit.edu.iq



Introduction

Owing to the nature of lawn tennis and the movement patterns involved, whether in a match or in training, these movements require a high level of exertion from the muscular system of the body, especially the lower limbs, in addition to the high pressure exerted on the joints. The fundamental skills of this sport are core components that are always sought to be improved by the coaches; they involve a range of strokes and turns of the body, depending on the rapid movement required to reach the various landing points of the ball. Therefore, the legs are responsible for all the movements in line with the play requirements. Therefore, the joints and leg movements should be strong enough to support the body weight during these movements, without ignoring the role of the supporting leg during the execution. The researcher agrees with (Ahmed, 2007) that although fundamental skills appear simple at the initial stages, they require a lot of effort to be executed, requiring that the player has high coordination levels appropriate for the nature of the game.

TAE-BO training is recognized as the best fitness program and a form of aerobic exercise. It is widely practiced owing to its outstanding and varied motor types, which greatly enhance muscular power, flexibility, reaction time, balance, and neuromuscular coordination, besides increasing the player's self-confidence (ASE, 1999). It is stated that regular compliance with these exercises bears a significant effect on increasing players' physical efficiency in terms of endurance, strength, agility, and balance, which enhances neuromuscular coordination of the legs (Lauren and Vinopal: 2024). The researcher argues that these exercises can be used in the rehabilitation process following an injury, owing to the emphasis on flexibility, which increases the range of motion (ROM) of the legs, thus highly preventing injuries.

The link between coordinative abilities and physical/skill-related factors makes them a necessity for success in all sports-related activities. These abilities do not occur in a separate manner but are interrelated, leading to the coordination of gross and fine motor skills. It is stated that the greater the coordination of these abilities, the greater the ability of the player to reach the highest level of motor coordination. Thus, the difference in levels of motor ability is dependent on the player's accuracy and skill (Kamil and Ibrahim, 2005).

In some movements, the body performs signals related to "inhibition" or not acting until the right time. This inhibition is related to the proper use of energy and its proper direction. In this state of "alert stillness," the player has a complete field of attention, noting the conditions experienced in these movements. Otherwise, they may feel that stillness is related to over-exertion or a collapse leading to energy loss. Coordinative abilities are a set of requirements for the processes of control, coordination, and organization of motor activity by the Central Nervous System (CNS) to improve the ability to perform complex motor skills quickly and accurately with less effort (Zahradnik, 2012). Despite the fact that ankle ligament injuries are most common among tennis players, there is a lack of research studies related to the integration of Tae-Bo into rehabilitation programs to enhance coordinative abilities. This leads to the need for an experimental study to confirm the effectiveness of these interventions, which emphasizes the significance of the present study.

While various rehabilitation programs exist, a common goal of returning the injured player to the field as quickly as possible is shared among them all. Statistical reports indicate that ankle



ligament injuries represent approximately 20–30% of sports injuries in games requiring rapid changes of direction. This underscores the need to develop rehabilitation programs that enhance neuromuscular control and coordinative abilities. Through the researcher's observation, most training regimens for tennis players lack the coordinative aspects that improve neuromuscular harmony, especially since the nature of the sport demands such abilities to avoid erroneous movements that lead to injuries, most notably ankle ligament tears. Therefore, the researcher sought to develop and utilize Tae-Bo exercises for the rehabilitation of this specific injury.

The Research Objectives

1. To design a rehabilitation program supported by Tae-Bo exercises.
2. To identify the effect of this Tae-Bo-supported program on the rehabilitation of ankle ligament tears.
3. To identify the effect of the program on developing certain coordinative abilities in patients with ankle ligament tears.

The Research Hypotheses

There are statistically significant differences between the pre-test and post-test measurements in favor of the post-test.

Definition of Key Terms

Tae-Bo Exercises: A modern fitness program style practiced to improve physical fitness and benefit the body's vital systems (Basmat, 2006).

Methodology

Research Design and Field Procedures

The researcher employed a one-group with pretest-posttest experimental design, as it is the most appropriate for the nature of the present study.

The Research Population and Sample

The population for the study includes (7) players from Karbala clubs suffering from ankle ligament tears. After a clinical examination by a specialist physician to identify the nature and extent of the injury through Magnetic Resonance Imaging (MRI), it was revealed that three players did not suffer from ankle ligament tears. Thus, the sample was limited to players with second-degree ligament tears who had not participated in any previous rehabilitation program within the last three months. The final research sample included (4) players .

Data Collection Tools and Equipment

1. Data Collection Tools



1. Scientific references and literature.
2. Interviews .
3. Internet resources .
2. Equipment and Devices
1. Magnetic Resonance Imaging (MRI) .
2. Infrared radiation therapy device .
3. Samsung camera (Korean made) .
4. Color-coded resistance bands .
5. Benches .
6. Various free weights .
7. Rubber balls .

Identification of the Research Variables

The researcher identified the research variables by scanning some previous studies related to the current study, such as (Ahmed, 2021; Abdulmaqsoud and Abdulaziz, 2024; Kilani, 2024). The variables included coordinative abilities, namely:

- Eye-foot coordination.
- Dynamic balance.
- Speed of movement.

Selection of Appropriate Tests

In order to establish a mechanism for selecting appropriate tests for the sample members, the researcher selected tests that are compatible with the type of injury. This was done to evaluate the ability of the patients to perform some tasks, which will enable the researcher to design a rehabilitation program based on scientific foundations that are compatible with the type of injury. The tests are defined as follows:

1. Dynamic Balance Test: (Filipa, 2010).

Purpose: To assess dynamic balance (Star Excursion Balance Test - SEBT pattern).

Tools: Flat surface, measuring tape, floor adhesive tape.

Procedure: The subject stands with the affected leg (supporting leg) at the midpoint. The subject is asked to reach as far as possible with a gentle touch using the big toe of the unaffected leg, and then bring the leg back to the initial position while keeping the balance of the supporting leg. The



exercise is done in the Anterior (A), Posteromedial (B), and Posterolateral (C) directions. In the posterolateral direction, the unaffected leg passes behind the supporting leg. In the other directions, it passes in front of the supporting leg. The subject is given (6) practice trials for each direction, followed by a (5-minute) rest, and then (3) trials are recorded for each direction. If there is any loss of balance or excessive weight-bearing on the unaffected leg the trial is considered invalid.

Scoring : The distance (cm) from the center to the furthest point touched is recorded for each required direction .

2. Numbered Circles Test (Salloum, 2004)

Purpose : To measure eye-foot coordination .

Tools: Stopwatch , eight circles drawn on the ground (60 cm diameter each) numbered 1-8 .

Procedure: The participant stands in circle (1) . On the start signal they jump with both feet together sequentially to circles 2 , 3 through 8 at maximum speed .

Scoring: The total time taken to complete all eight circles is recorded .

3. Movement Speed Test (Clark, 2001)

Purpose: To measure movement speed (Lateral Hop Test) .

Tools: Flat ground , white adhesive tape (15 cm width) .

Measurement Unit: Seconds/Repetitions .

Procedure : The participant stands behind the starting line on the injured leg and begins jumping laterally across the 15 cm wide line landing on the same leg . If the foot touches the line the trial is invalid . Two trials are given ; the best one is recorded .

Scoring: The number of successful hops completed within (10) seconds is recorded .

Pilot Study

The pilot study functions as a small-scale trial that replicates the conditions of the main experiment. Therefore, the researcher conducted the pilot study on June 3, 2025. The aim of the pilot study was to check the validity of the rehabilitation exercises, the appropriateness of the exercises to the sample, the time taken to perform the exercises, and the time taken for the testing procedures.

Pre-tests

After the specialist physician verified the recovery of the participants and the reduction of pain in the ankle joint, the researcher carried out the pre-tests on June 5, 2025. The tests were carried out at the tennis grounds of the Faculty of Physical Education and Sports Sciences in Karbala.



Main Experiment (The Rehabilitation Program)

The researcher conducted the main experiment on TAE-BO training based on a studied mechanism. The training was divided into two phases:

Phase I (4 weeks): In this phase, emphasis is placed on the use of resistance bands to improve the strength of muscles around the ankle joint, in addition to body weight resistance exercises to enhance the load on the joint. This phase included passive and active flexibility exercises to improve Range of Motion (ROM). Most of the exercises were based on neuromuscular coordination, which aimed at achieving dynamic balance and optimal muscle activation (agonist-antagonist coordination) to promote energy-efficient movement. Intensity was maintained at 60-70% of maximum repetition .

Phase II (Final 4 weeks) : In this phase , progressive weights were added to improve the strength of muscles that had become inefficient due to atrophy during the injury period . Tae-Bo training continued along with these weights which targeted supporting muscles and prime mover muscles.

Program Parameters

Total Duration: 8 weeks .

Frequency: 3 sessions per week (Sunday , Tuesday , Thursday) .

Session Duration: Each session lasts for 45 minutes .

Intensity: Gradual increase reaching 75-80% with careful coordination of volume and rest periods .

Post-tests

The post-tests were carried out on September 28, 2025 to ensure that the same conditions were met as in the pre-tests thus ensuring internal validity .

Statistical Analysis

The data was analyzed using the SPSS package, employing the following:

1. Mean .
2. Median .
3. Standard Deviation .
4. T-test .

Results

Table 1. Means, Standard Deviations, and Calculated (*t*) Values for Selected Coordinative Abilities

No.	Variables	Unit	Pre-test (M±SD)	Post-test (M±SD)	t-value	Sig. (p)	Significance
1	Dynamic Balance	cm	\$1.89 \pm 1.65\$	\$0.34 \pm 0.46\$	2.56	0.000	Significant
2	Coordination	sec	\$8.56 \pm 2.49\$	\$6.43 \pm 1.27\$	2.77	0.000	Significant
3	Motor Speed	degree	\$14.76 \pm 2.66\$	\$11.23 \pm 1.19\$	2.97	0.001	Significant

Results are considered statistically significant when the p-value is ($\text{Sig} \leq 0.05$), at degrees of freedom of ($n - 1$) = 4 - 1 = 3.

Discussion

Table (1) reveals that there are major differences between the pre-test and post-test results in favor of the post-test for all the research variables. The researcher relates this positive change to the rehabilitation program enhanced by Tae-Bo exercises. These findings indicate the appropriateness of these exercises to the nature and intensity of the injury, as the gradual transition from simple to complex movements had a positive effect on the research sample. Moreover, the structuring of the program duration based on scientific criteria and appropriateness to the exercises had a major effect on the experimental group, resulting in a dramatic positive change in the coordinative capabilities being examined.

The researcher also gives credit to the utilization of specialized tools that had a major positive effect on the muscular strength of the muscles involved in the ankle joint, hence affecting the ligaments that were previously injured. The emphasis on both the supporting and agonist muscles had a major positive effect on the improvement of the motor component and neuromuscular coordination. The Tae-Bo training had a positive effect on the improvement of total body control and increasing the capacity to produce power and speed in the direction of movement (acceleration and deceleration) while maintaining balance. Quick changes in body positions, along with proper spatial awareness and perception, are major requirements for this sport.

The researcher states that the enhanced coordinative capabilities later strengthened the muscles of the ankle joint for balance, flexibility, and strength. This is in line with Blanks (2006) who argues that Tae-Bo is an integrated and continuous program that enhances physical fitness and technical skills by relating to the motor pathways of different specialized sports activities.

Methodological Focus: Phase I and II

During the first four weeks, the researcher concentrated on strengthening the ligaments around the ankle joint to withstand the requirements of competitive play. In tennis, there is multi-directional movement, where the ankle joint supports the weight of the entire body during all movements and turns. The possession of coordinative capabilities enables the player to cope with different performance requirements; since the conditions of competition in tennis are constantly



changing due to the ball and the opponent, coordinative capabilities are the main mechanism for motor control. This enables the player to attain optimal coordination and performance, as indicated by Dollar and Muhammad(2014) .

During the second four weeks, the researcher combined different weights, such as medicine balls and BOSU balls (half-rubber balls attached to the floor). The aim was to strengthen the agonist muscles of the ankle joint and the ligaments. The focus was on exercises that target static, dynamic, supporting, and antagonist muscles for all movements that simulate the sport. The intensity, volume, and recovery time of the exercises were adjusted according to the nature of the injury.

Biomechanical Mechanisms

Most of the exercises involved the mechanism of "Alert Stillness" (Vigilant Isometrics). These injuries need a state of stillness in which the patient is alert and concentrates on the inhibition of certain muscle groups and the activation of others. This aspect makes the Electromyography (EMG) activity of the muscles maximal and improves neuromuscular coordination around the ankle joint. The inhibitory impulses ensure that nothing happens until the right time, involving accurate energy control and guidance. The researcher has also used the aspect of mass of the subject in the rehabilitation process. The presence of force does not necessarily mean the presence of motion because force can be a change or an attempt to change the kinetic or structural state of the body. An applied force may not be able to overcome the inertia of the body and thus may not bring about the desired change (Ahmed, 2023).

Analysis of Coordinative Variables

The findings of the present study reveal positive changes in the following areas:

Neuromuscular Coordination: There was an improvement in absolute strength (muscle strength irrespective of body weight). Since technical skill involves maximum absolute strength, where all muscle groups (not only flexors or extensors) are involved in the movement, the researcher stresses the importance of this overall involvement.

Kinetic Balance: Tae-Bo training increased the strength of the flexor and extensor muscles of the joint. This increased strength enables the patient to control their movements in all directions, which in turn increases the ability to control the free leg and the supporting leg during technical skill performance (Farhan and Al-Mu'min, 2025).

Motor Speed and Agility: Training included agility exercises that originated from increased strength in the legs. In tennis, high agility is required because of the positions of the body during play, which involve multi-directional movements, bending, and turning while maintaining speed and balance. Hence, the research hypothesis is accepted.

Conclusions

1. The rehabilitation program with support from Tae-Bo exercise has a significant effect on



rehabilitating the ligaments of the ankle joint.

2. Tae-Bo training has a positive effect on the studied coordinative abilities.
3. The Alert Stillness mechanism is effective in rehabilitating the tear in the ligaments of the ankle joint and improving specific coordinative abilities.
4. The combination of Tae-Bo training and the Alert Stillness mechanism led to a significant improvement in the studied research variables.
5. The results of this study indicate that Tae-Bo training can be effectively used in rehabilitation programs.

Recommendations

1. Modern training methods, such as Tae-Bo training, should be used in rehabilitation programs.
2. Exercise programs should be designed according to the specific biomechanical mechanism of the injury.
3. The Alert Stillness mechanism should be applied to the rehabilitation of other joints in the body.
4. Future studies should be carried out with larger samples and more experimental designs to further confirm the findings.



References

- Abduldayem, M. A. (). The effect of Tae-Bo training on some specific coordination abilities and the level of technical and tactical performance for Taekwondo players. *Assiut Journal of Sports Science and Arts*, 54(4).
- Abdullah, A. (2007). Table tennis: Theories, applications, and laws. Sport World Foundation.
- Abdulmaqsoud, and Abdulaziz, R. (2024). The effect of some specific coordination abilities on the performance level of junior table tennis players. *Journal of Physical Education Research and Sports Science*, 3(4).
- ACE. (1999). ACE helps exercisers kick their way to fitness with cardio kickboxing. American Council on Exercise.
- Ahmed, W. (2023). Biomechanics lectures for doctoral students. Mustansiriya University.
- Al-Khafaji, S. (2024). The relationship of some bio kinematic variables of the throwing phase and their relationship to achievement for javelin throwers under 20 years old. *Wasit Journal of Sports Sciences*, 21(4), 282–294. <https://doi.org/10.31185/wjoss.648>
- Basmat, M. (2006). The effect of Tae-Bo training on improving some physical fitness elements and performance levels for female karate players. Minia University, Faculty of Physical Education, *Journal of Sports Sciences*.
- Blanks, B. (2006). Discovering revolutionary personal and progressive (B. Blanks, Ed.).
- Clark, N. C. (2001). Functional performance testing following knee ligament injury. *Physical Therapy in Sport*, 2(2), 91.
- Dollar, O. and Karim, M. (2014). Standard levels for some coordination abilities for junior tennis players (15-17 years) An MA Thesis, Mansoura University]. Faculty of Physical Education.
- Ali, F. H. M., & Al-Mu'min, H. S. (2025). The effect of an e-learning program supported by expert systems on cognitive flexibility and learning some basic football skills for students. *Wasit Journal of Sports Sciences*, 23(1), 775–789. <https://doi.org/10.31185/wjoss.846>
- Farhan, M. M. A., and Farhan, H. M. A. (2025). The effectiveness of special exercises accompanied by the nutritional supplement (Extend BCAA) in the rehabilitation of carpal tunnel injury in advanced football goalkeepers. *Journal of Studies and Research of Sport Education*, 35(2), 577–594.
- Filipa, A. (2010). Neuromuscular training improves performance on the star excursion balance test in young female athletes. *Journal of Orthopaedic and Sports Physical Therapy*, 40(9).
- Kamil, O. and Ibrahim, M. (2012). Growth and motivation in directing children's motor activity and school sports activities. *Dar Al-Fikr Al-Arabi*.
- Kilani, I. E. (2024). Some coordination abilities on the technical performance of junior table tennis players. *Journal of Theories and Applications of Physical Education and Sports Sciences*, 64(1).
- Liemohn, W., and Pariser, G. (2002). Strength: Implications for fitness and low back pain. *ACSM's Health and Fitness Journal*, 6(5).
- Salloum, A. J. (2004). Tests, measurement, and statistics in the sports field (1st ed.). Al-Tayf Press.
- Vinopal, L. (2024). Remember Tae Bo? We revisited the punchy aerobics class. *InsideHook*.



Journal of Physical Education

Volume 38 – Issue (3) – 2026 Open Access

P-ISSN: 2073-6452 , E-ISSN: 2707-5729

<https://jcope.uobaghdad.edu.iq>



Zahradnik, D. (2012). Training coordination abilities (1st ed.). Masaryk University.