Clinical Trial Protocol
Iranian Registry of Clinical Trials

10 Jun 2026

Effect of Six Weeks Reactive Neuromuscular Training on Balance and Performance in Volleyball Players with Anterior Cruciate Ligament Reconstruction

Protocol summary

Study aim

This study investigates the effectiveness of a six-week reactive neuromuscular training program in enhancing balance and performance in these athletes.

Design

A controlled clinical trialو with a parallel-group design, single-blind, randomized, phase 2, was conducted on 30 patients. G Power software was used for randomization.

Settings and conduct

The Declaration of Helsinki conducted This randomized clinical trial involving 30 male volleyball players in Quchan with a history of ACL reconstruction. Using simple random sampling, participants were randomly assigned to an exercise group (n=15) and a control group (n=15). Single-blinding was applied, with participants unaware of group assignments. Informed consent and medical history were collected before the study.

Participants/Inclusion and exclusion criteria

Inclusion Criteria: Participants aged 18-30 years with at least 12 months post-ACL reconstruction, a minimum of three years of regular volleyball experience (three sessions per week), no persistent lower limb injuries or abnormalities, and no participation in ACL prevention programs. Exclusion Criteria: Non-compliance, failure to complete the protocol or post-test, sports injuries, pain during training, or missing more than two sessions.

Intervention groups

The intervention group participated in a Reactive Neuromuscular Training program over six weeks. The exercises aimed to improve balance, agility, and proprioception while reducing incorrect movement patterns. A trainer supervised the sessions and was involved in using Thera-bands to challenge stability. The control group received no intervention and continued daily activities without specific training.

Main outcome variables

Balance, Performance

General information

Reason for update

Acronym

IRCT registration information

IRCT registration number: **IRCT20110803007211N6**
Registration date: **2025-01-15, 1403/10/26**
Registration timing: **retrospective**

Last update: **2025-01-15, 1403/10/26**
Update count: **0**

Registration date

2025-01-15, 1403/10/26

Registrant information

Name

Name of organization / entity

Country

Iran (Islamic Republic of)

Phone

05714413512

Email address

mseyedahmadi@gmail.com

Recruitment status

Recruitment complete

Funding source

Expected recruitment start date

2025-01-04, 1403/10/15

Expected recruitment end date

2025-01-14, 1403/10/25

Actual recruitment start date

empty

Actual recruitment end date

empty

Trial completion date

empty

Scientific title
Effect of Six Weeks Reactive Neuromuscular Training on Balance and Performance in Volleyball Players with Anterior Cruciate Ligament Reconstruction

Public title
The Impact of Neuromuscular Training on Balance and Performance Improvement in Volleyball Players

Purpose
Supportive

Inclusion/Exclusion criteria

Inclusion criteria:
1. Age between 18 and 30 years 2. History of anterior cruciate ligament (ACL) reconstruction at least 12 months prior to the start of the study; 3. Return to unrestricted sports participation without reported limitations; 4. Minimum of three years of regular participation in volleyball; 5. An average of three volleyball training sessions per week; 6. No significant lower limb abnormalities (e.g., hip anteversion, genu valgum, genu varum, tibial torsion, or flat feet);

Exclusion criteria:
(1) Non-compliance with study procedures (2) Failure to complete the protocol; (3) Occurrence of a sports injury resulting in absence from training; (4) Development of pain during training; (5) Failure to complete the post-test (6) Missing more than two training sessions.

Age
From **18 years** old to **30 years** old

Gender
Male

Phase
N/A

Groups that have been masked

- Investigator
- Outcome assessor

Sample size
Target sample size: **30**

Randomization (investigator's opinion)
Randomized

Randomization description
In this study, the randomization process of participants will be conducted using Random Allocation Software 2.0 through the block randomization method to ensure a balanced distribution across the groups. The unit of randomization will be individual. The random sequence generated by the software will be placed in sealed and numbered envelopes, which will be opened sequentially after the initial assessment of participants and confirmation of the inclusion criteria. This method ensures allocation concealment, reducing bias and improving the accuracy of the study results.

Blinding (investigator's opinion)
Single blinded

Blinding description
Considering the nature of the intervention in this study, which involves neuromuscular reactive exercises, blinding participants is not feasible. The specific exercises performed by the experimental group are easily distinguishable by the participants, making it impractical to achieve participant-level blinding. However, to reduce assessment bias, the outcome evaluations will be conducted by independent assessors blinded to group allocation, and the random allocation of participants to groups will be handled by an independent person who is not involved in data collection or intervention delivery. This ensures that blinding is maintained at the level of outcome assessors and the randomization process, which contributes to reducing bias and improving the validity of the study results. Additionally, this limitation will be clearly stated in the discussion and limitations section of the final manuscript.

Placebo
Not used

Assignment
Single

Other design features

Secondary Ids

empty

Ethics committees

1

Ethics committee

Name of ethics committee
Ethics Committee of Sport Sciences Research Institute

Street address
No. 3, 5th Alley, Miremad Street, Motahhari Street, Tehran, Iran.

City
Tehran

Province
Tehran

Postal code
1587958711

Approval date
2024-07-10, 1403/04/20

Ethics committee reference number
IR.UOZ.REC.1403.017

Health conditions studied

1

Description of health condition studied
Anterior Cruciate Ligament (ACL) Tear

ICD-10 code
M95.8

ICD-10 code description
Other specified acquired deformities of musculoskeletal system

Primary outcomes

1

Description

Balance

Timepoint

At the beginning of the study (before the start of the intervention) and at the end of the study (6 weeks after the intervention)

Method of measurement

Y-Balance Test: The test measures dynamic balance in three directions (anterior, posteromedial, and posterolateral). The participant pushes a movable platform with their non-dominant foot while standing on the dominant foot. The reach distance, expressed as a percentage of leg length, is averaged over three attempts. The test shows high reliability for both individual directions and total scores.

2

Description

Motor Performance (Vertical Jump, Triple Hop, Single-Leg 6-Meter Hop)

Timepoint

At the beginning of the study (before the intervention) and at the end of the study (6 weeks after the intervention)

Method of measurement

Vertical Jump Test: This test evaluates the explosive power of the lower limbs in the vertical direction. The participant jumps three times, and the distance between the zero point and the highest jump is measured. The average of the three attempts is recorded as the final score. Triple Hop Test: This test assesses the power, speed, balance, and coordination of the lower limbs. The participant performs three consecutive hops with the dominant foot, and the distance from the starting line to the point where the heel touches the ground during the third hop is measured. Single-Leg 6-Meter Hop Test: This test evaluates power, speed, and balance with an emphasis on time. The participant covers a 6-meter distance with consecutive hops as fast as possible. The time taken from the starting line to crossing the finish line is recorded, and the best time from three attempts is considered the final result.

Secondary outcomes

empty

Intervention groups

1

Description

Intervention group: The Reactive Neuromuscular Training (RNMT): protocol aimed to improve movement patterns through self-adjustment and minimal verbal feedback. Conducted over six weeks with 18 sessions (three per week, each 60 minutes), it included a 10-minute warm-up, 40 minutes of balance, agility, and proprioception exercises, and perturbation forces using Thera-bands. Intensity was tailored using the Borg Scale (level ≤6) to prevent fatigue, focusing on correcting knee valgus and ensuring proper movement. Exercises involved static and dynamic tasks for stability, agility drills, and proprioceptive activities. The control group maintained daily routines without training, and the protocol emphasized movement quality over cardiovascular endurance.

Category

Rehabilitation

2

Description

Control group: The control group in this study did not receive any intervention and continued with their daily activities.

Category

Rehabilitation

Recruitment centers

1

Recruitment center

Name of recruitment center

Corrective Exercise clinic

Full name of responsible person

Karim Khalaghi

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Sponsors / Funding sources

1

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Name of organization / entity

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Full name of responsible person

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Grant name
Grant code / Reference number
Is the source of funding the same sponsor organization/entity?
No
Title of funding source
Research Deputy of Hakim Nizami Institute of Higher Education,
Proportion provided by this source
100
Public or private sector
Private
Domestic or foreign origin
Domestic
Category of foreign source of funding
empty
Country of origin
Type of organization providing the funding
Academic

Person responsible for general inquiries

Contact
Name of organization / entity
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Person responsible for updating data

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Sharing plan

Deidentified Individual Participant Data Set (IPD)
Yes - There is a plan to make this available
Study Protocol
No - There is not a plan to make this available
Statistical Analysis Plan
No - There is not a plan to make this available
Informed Consent Form
Yes - There is a plan to make this available
Clinical Study Report
No - There is not a plan to make this available
Analytic Code
No - There is not a plan to make this available
Data Dictionary
No - There is not a plan to make this available
Title and more details about the data/document
Data related to the Effect of Six Weeks of Reactive Neuromuscular Training on Balance and Performance in Volleyball Players with Anterior Cruciate Ligament Reconstruction includes body status information (balance and motor performance) and questionnaire data for 30

participants (15 intervention, 15 control) in Excel or SPSS file formats. The data will be available one week after an official request and compliance with ethical considerations.

When the data will become available and for how long

After the article's publication, upon request from the corresponding author, the data will be sent within one week.

To whom data/document is available

All researchers working in this field of study.

Under which criteria data/document could be used

The data will be generalizable and usable for conducting similar studies on comparable groups.

From where data/document is obtainable

An email should be sent to Mr. Mohammad Seyedahmadi, the corresponding author, at Mseyedahmadi@gmail.com.

What processes are involved for a request to access data/document

After emailing the corresponding author, the requested data will be sent within one week.

Comments