Clinical Trial Protocol
Iranian Registry of Clinical Trials

22 Nov 2026

Effects of Adding Perturbation Exercises to Scapular Stabilization Training on Scapula Two-Dimensional Kinematics, Proprioception, Strength, and Endurance, and Function of Upper extremity, in Overhead Athletes with Fatigue-Induced Scapular Dyskinesis

Protocol summary

Study aim

To investigate the effect of adding perturbation exercises to scapular stabilizing exercises on scapular two-dimensional kinematics, proprioception, strength, endurance, and upper extermity function in overhead athletes with fatigue-induced scapular dyskinesis.

Design

A single-blind, randomized controlled trial with three parallel groups will include 48 overhead athletes with fatigue-induced scapular dyskinesis. Participants will be randomized (1:1:1) using Random.org, with allocation concealment ensured by opaque, sealed envelopes.

Settings and conduct

The study will be conducted in selected clubs in Tehran, Karaj, and Mazandaran. Eligible athletes with fatigue-induced scapular dyskinesis will be randomized into three groups. Assessments will be conducted at baseline and after 8 weeks. Intervention groups will train three times weekly, while controls maintain usual activities. Assessors and data analysts will be blinded to group allocation.

Participants/Inclusion and exclusion criteria

Inclusion criteria: Overhead athletes aged 20–40 years with a minimum of 4 hours of weekly activity, a body mass index between 18.5 and 25, normal scapular movement pattern at rest, and scapular dyskinesis following the fatigue protocol. Exclusion criteria: History of shoulder injury or surgery, musculoskeletal disorders, or structural abnormalities of the spine and lower extremities.

Intervention groups

The SST and SST+PT groups will train three times weekly for 8 weeks. Both will perform identical initial 30-minute sessions, followed by 15 minutes of non-perturbation or perturbation exercises, respectively. Controls will continue usual activities.

Main outcome variables

Two-Dimensional Scapular Kinematics; Shoulder Proprioception; Shoulder Rotator Muscle Strength; Scapular muscle endurance; Upper Extremity Function

General information

Reason for update

Acronym

IRCT registration information

IRCT registration number: **IRCT20260701070041N1**
Registration date: **2026-10-14, 1405/07/22**
Registration timing: **prospective**

Last update: **2026-10-14, 1405/07/22**
Update count: **0**

Registration date

2026-10-14, 1405/07/22

Registrant information

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Recruitment status

recruiting

Funding source

Expected recruitment start date

2026-10-17, 1405/07/25

Expected recruitment end date
2026-12-10, 1405/09/19
Actual recruitment start date
empty
Actual recruitment end date
empty
Trial completion date
empty

Scientific title
Effects of Adding Perturbation Exercises to Scapular Stabilization Training on Scapula Two-Dimensional Kinematics, Proprioception, Strength, and Endurance, and Function of Upper extremity, in Overhead Athletes with Fatigue-Induced Scapular Dyskinesis

Public title
Effects of Adding Perturbation Exercises to Scapular Stabilization Training on Scapula Two-Dimensional Kinematics, Proprioception, Strength, and Endurance, and Function of Upper extremity, in Overhead Athletes with Fatigue-Induced Scapular Dyskinesis
Purpose
Treatment
Inclusion/Exclusion criteria
Inclusion criteria:
-Participants must demonstrate a normal scapular pattern at rest and exhibit scapular dyskinesis following a standardized fatigue protocol, as assessed by the Kibler test. -Participants must be actively engaged in overhead sports for at least 4 hours per week. -Age of participants must be between 20 and 40 years. -Body mass index (BMI) must be between 18.5 and 25 kg/m².
Exclusion criteria:
1. History of shoulder pain within the past year. 2. Capsular shoulder stiffness (adhesive capsulitis). 3. Previous shoulder surgery within the past year. 4. History of shoulder fracture. 5. Systemic musculoskeletal diseases (e.g., rheumatoid arthritis, fibromyalgia, etc.). 6. Shoulder pain reproduced by active or passive cervical spine movements. 7. History of rotator cuff or labral tears. 8. Shoulder dislocation within the past year. 9. Current or previous glenohumeral instability. 10. Clavicle or humerus fracture. 11. Cervical radiculopathy. 12. Spinal deformities such as scoliosis. 13. Thoracic kyphosis outside normal range. 14. Cervical hyperlordosis. 15. Lower limb length discrepancy.
Age
From **20 years** old to **40 years** old
Gender
Both

Phase
N/A
Groups that have been masked

- Outcome assessor
- Data analyser

Sample size
Target sample size: **48**
Randomization (investigator's opinion)
Randomized
Randomization description
Stratified randomization by sport, using random blocks and a 1:1:1 allocation ratio within each stratum, will be performed. The allocation sequence will be generated using a computerized random sequence generation tool (Random.org). Allocation concealment will be ensured using sequentially numbered, opaque, sealed envelopes. Group allocation will be performed after completion of the baseline assessments.
Blinding (investigator's opinion)
Single blinded
Blinding description
This study will be conducted using a single-blind design. The outcome assessor will be blinded to participants' group allocation during both baseline and post-intervention assessments. The data analyst will also perform the statistical analyses using group codes A, B, and C without knowledge of the nature of the groups, and the group codes will be revealed after completion of the statistical analyses. Due to the nature of the interventions, participants and intervention providers will be aware of their group allocation.
Placebo
Not used
Assignment
Parallel
Other design features

Secondary Ids

empty

Ethics committees

1

Ethics committee
Name of ethics committee
Ethics Committee of Kharazmi University
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Center for Human Movement Sciences, Kharazmi University, Hesari St, Mirdamad St.
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Approval date
2026-06-17, 1405/03/27
Ethics committee reference number
IR.KHU.REC.1405.033

Health conditions studied

1

Description of health condition studied
Scapular Dyskinesis
ICD-10 code
M99.9
ICD-10 code description
Biomechanical lesion, unspecified

Primary outcomes

1

Description
Two-dimensional scapular upward rotation
Timepoint
Baseline (T0), post-intervention (T1, 8 weeks; at least 48 hours after the last training session).
Method of measurement
Scapular two-dimensional kinematics will be assessed using two calibrated gravity-based inclinometers. One inclinometer (I1) will be attached to the distal humerus to record total shoulder abduction, and the second inclinometer (I2) will be placed on the scapular spine to assess scapular upward rotation. Measurements will be taken at 45°, 90°, 135°, and at the end range of shoulder abduction. Each measurement will be repeated twice within the same session.

Secondary outcomes

1

Description
shoulder proprioception
Timepoint
Baseline (T0), post-intervention (T1, 8 weeks; at least 48 hours after the last training session).
Method of measurement
Proprioception will be assessed using the joint position sense (JPS) test. Participants will lie supine with the shoulder abducted to 90° and the elbow flexed to 90°. A blindfold will be used to eliminate visual input. The examiner will passively move the shoulder to target angles of 45° and 80° of external rotation and hold each position for 5 seconds. Participants will then actively reproduce the target angle. Absolute error (degrees) between the target and reproduced angles will be calculated as the outcome measure.A digital camera positioned at 10 meters will be used for recording, and angles will be calculated using Kineova software. Anatomical reference lines include the horizontal line of the plinth and the line from the olecranon to the ulnar styloid process.

2

Description
upper extermity function
Timepoint
Baseline (T0), post-intervention (T1, 8 weeks; at least 48 hours after the last training session).
Method of measurement
The Closed Kinetic Chain Upper Extremity Stability Test (CKCUEST) will be performed using two parallel tape lines placed 91.44 cm (36 inches) apart. Participants will assume a push-up position with each hand placed on a separate line. The test duration is 15 seconds, during which participants will alternately touch the opposite line as many times as possible. One familiarization trial (submaximal effort) will be performed followed by three maximal trials. A 45-second rest period will be provided between trials (work-to-rest ratio 1:3). The mean of the three trials will be used for statistical analysis.

3

Description
Shoulder rotator strength
Timepoint
Baseline (T0), post-intervention (T1, 8 weeks; at least 48 hours after the last training session).
Method of measurement
Shoulder rotator muscle strength will be assessed using a handheld dynamometer. Measurements will be performed in three positions: seated with 0° adduction (neutral), prone with 90° abduction, and seated with 30° abduction + 30° scaption + 30° diagonal position. The elbow will be flexed to 90° during all tests. The make contraction method will be used, where participants gradually reach maximal force over 2 seconds and maintain it for 5 seconds. If the participant is unable to maintain force, the trial will be repeated. Force will be applied 1.3 cm proximal to the ulnar styloid process. Maximal isometric force will be recorded in Newtons (N), and the external rotation to internal rotation (ER/IR) strength ratio will be calculated. The order of positions, limb tested, and movement type will be randomized.

4

Description
Scapular muscle endurance
Timepoint
Baseline (T0), post-intervention (T1, 8 weeks; at least 48 hours after the last training session).
Method of measurement
Scapular muscle endurance will be assessed in a standing position facing a wall. The shoulder and elbow will be positioned at 90° flexion. A dynamometer will be placed between the hands, and a distance gauge will be used to control elbow position. Participants will maintain a resistance of 1 kg during external rotation and hold the position until fatigue. The test will be terminated when the participant is unable to maintain the target resistance, when elbow position deviates from the required distance, or when the 90° joint angle is lost.

Intervention groups

1

Description
Intervention Group 1 (SST): Participants in this group will participate in a structured scapular stabilization training program for 8 weeks, with three supervised sessions per week. Each 60-minute session will consist of 10 minutes of warm-up, 45 minutes of main exercise, and 5 minutes of cool-down. During the first 30 minutes of the main exercise period, participants will perform the standardized scapular stabilization training program. The final 15 minutes will consist of an active non-perturbation program matched for time and therapist attention.

Exercise intensity will be prescribed using the RPE scale and progressively adjusted based on maintenance of movement quality and scapular control.

Category

Treatment - Other

2

Description

Intervention Group 2 (SST+PT): Participants in this group will participate in a structured scapular stabilization training program combined with perturbation training for 8 weeks, with three supervised sessions per week. Each 60-minute session will consist of 10 minutes of warm-up, 45 minutes of main exercise, and 5 minutes of cool-down. During the first 30 minutes of the main exercise period, participants will perform the same standardized scapular stabilization training program as the SST group. The final 15 minutes will consist of a specific program incorporating dynamic stabilization and perturbation exercises. This component will progress in stages over the 8-week intervention. Exercise intensity will be prescribed using the RPE scale and progressively adjusted based on maintenance of movement quality and scapular control.

Category

Treatment - Other

3

Description

Control group: Group 3: No exercise intervention (usual upper extremity activity group). Group 3 will not receive any structured exercise program during the 8-week study period and will continue their usual daily and sporting activities. No specific scapular Stabilization or perturbation exercises will be provided. The control group is included for comparison with the intervention groups.

Category

Treatment - Other

Recruitment centers

1

Recruitment center

Name of recruitment center

Overhead sports clubs, training centers, and sports facilities in Tehran, Alborz, and Mazandaran pro

Full name of responsible person

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Sponsors / Funding sources

1

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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

This study was conducted by the researchers and did not receive any organizational funding.

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

Other

Person responsible for general inquiries

Contact

Name of organization / entity

The University of Kharazmi

Full name of responsible person

Pejman Enayatzadeh Gerayli

Position

Master's Student

Latest degree

Bachelor

Other areas of specialty/work

Sport Medicine

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Sharing plan

Deidentified Individual Participant Data Set (IPD)
Undecided - It is not yet known if there will be a plan to make this available
Study Protocol
Undecided - It is not yet known if there will be a plan to make this available
Statistical Analysis Plan
Undecided - It is not yet known if there will be a plan to make this available
Informed Consent Form
Undecided - It is not yet known if there will be a plan to make this available
Clinical Study Report
Undecided - It is not yet known if there will be a plan to make this available
Analytic Code
Undecided - It is not yet known if there will be a plan to make this available
Data Dictionary
Undecided - It is not yet known if there will be a plan to make this available