Clinical Trial Protocol
Iranian Registry of Clinical Trials

22 Nov 2026

Comparison of Feedback-Based and Dual-Task Training on Lower Limb Biomechanics inMilitary Personnel with Patellofemoral Pain Syndrome

Protocol summary

Study aim

Determining the effect of feedback-based and dual-task exercises on lower limb biomechanical patterns in military personnel with patellofemoral pain syndrome.

Design

This research is of an applied type and is conducted with an experimental approach and a randomized controlled trial design with parallel groups and a pre-test-post-test design. The study population of this research will be practically limited to active military personnel and male armed forces soldiers aged 20 to 35, with a height of 165 to 185 and a weight of 65 to 85 kg in Quchan County, whom the researcher has access to. Participants are assigned to two feedback and dual-task groups using a Random Number Generator. Coding and maintenance of the random list is performed by an independent person to reduce the possibility of bias.

Settings and conduct

The study area is the rehabilitation of individuals with PFPS in Quchan city. The intervention includes two groups of subjects (feedback group and dual task group), each of which is subject to its own specific training program. The intervention period is 6 weeks, with 3 sessions held each week. Each session is 45 minutes long, and will include warm-up, main exercises, and cool-down, respectively.

Participants/Inclusion and exclusion criteria

Clinical diagnosis of PFPS by a specialist based on MRI images Ability to perform basic independent activities (with or without assistive devices such as crutches) No severe neurological disease or other musculoskeletal problems (such as severe knee osteoarthritis) that would interfere with the intervention No history of knee surgery in the past 6 months

Intervention groups

Feedback-Based Training Dual-Task Training

Main outcome variables

Knee valgus angle; Dynamic balance; Lower limb neuromuscular coordination; Pain intensity; Quadriceps and hamstring strength

General information

Reason for update

Acronym

PFPS

IRCT registration information

IRCT registration number: **IRCT20260511069346N1**
Registration date: **2026-06-03, 1405/03/13**
Registration timing: **registered_while_recruiting**

Last update: **2026-06-03, 1405/03/13**
Update count: **0**

Registration date

2026-06-03, 1405/03/13

Registrant information

Name

mojtaba khoshbaten

Name of organization / entity

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Recruitment status

Recruitment complete

Funding source

Expected recruitment start date

2026-05-12, 1405/02/22

Expected recruitment end date

2026-06-10, 1405/03/20

Actual recruitment start date

empty

Actual recruitment end date

empty

Trial completion date
empty

Scientific title
Comparison of Feedback-Based and Dual-Task Training on Lower Limb Biomechanics inMilitary Personnel with Patellofemoral Pain Syndrome

Public title
Comparison of two types of exercises on knee pain in military personnel

Purpose
Treatment

Inclusion/Exclusion criteria

Inclusion criteria:
Clinical diagnosis of PFPS by a specialist based on MRI Ability to perform basic independent activities (with or without assistive devices such as canes) Absence of severe neurological diseases (such as stroke or Parkinson's) or other musculoskeletal problems (such as severe knee osteoarthritis) that would interfere with the intervention No history of knee surgery in the past 6 months.

Exclusion criteria:
Presence of severe neurological disorders such as stroke or Parkinson’s disease Presence of musculoskeletal disorders affecting knee function, such as severe knee osteoarthritis History of knee surgery within the past 6 months Medical contraindication to participation in exercise or rehabilitation interventions Inability to perform basic independent activities, even with assistive devices Lack of confirmed diagnosis of patellofemoral pain syndrome (PFPS) based on MRI and specialist evaluation

Age
From **20 years** old to **35 years** old

Gender
Male

Phase
N/A

Groups that have been masked
No information

Sample size
Target sample size: **44**

Randomization (investigator's opinion)
Randomized

Randomization description
Participants are assigned to two feedback and dual-task groups using a Random Number Generator. Coding and maintenance of the random list is performed by an independent person to reduce the possibility of bias.

Blinding (investigator's opinion)
Not blinded

Blinding description

Placebo
Not used

Assignment
Parallel

Other design features

Secondary Ids

empty

Ethics committees

1

Ethics committee

Name of ethics committee
Research Ethics Committees of Baqiyatullah Hospital

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Approval date
2026-02-02, 1404/11/13

Ethics committee reference number
IR.BMSU.BAQ.REC.1404.141

Health conditions studied

1

Description of health condition studied
Patellofemoral pain syndrome

ICD-10 code
M22.2

ICD-10 code description
Patellofemoral disorders

Primary outcomes

1

Description
Pain by visual analog scale

Timepoint
6 week

Method of measurement
VAS Questionnaire

Secondary outcomes

empty

Intervention groups

1

Description
Feedback-Based Training: Feedback training is a neuromuscular intervention that uses real-time visual, auditory, or combined feedback to correct abnormal movement patterns. In individuals with Patellofemoral Pain Syndrome, this approach aims to reduce dynamic knee valgus, improve hip and knee joint control, and optimize mechanical load distribution across the

patellofemoral joint. During the intervention, participants perform functional movements such as squats, stair ascent, and stair descent while receiving immediate feedback to correct lower-limb alignment and movement quality.The equipment used in this intervention includes a full-length mirror for visual feedback, an interactive video projector to display correct movement patterns, a Kinect camera for real-time motion capture and display, and Kinovea software for biomechanical motion analysis. Additional training equipment includes resistance bands (TheraBand), light ankle weights ranging from 0.5 to 2 kg, adjustable aerobic steps, exercise mats, and balance foam pads.The intervention program lasts for six weeks and consists of three sessions per week, for a total of 18 sessions. Each session lasts approximately 45 minutes. Before the intervention begins, participants attend a 60-minute introductory session that includes explanation of the study objectives, instruction on proper exercise execution, familiarization with the feedback devices, practice of basic movements, and education regarding pain-monitoring and exercise termination criteria.Each training session begins with a 5–7 minute warm-up consisting of light walking, hip-knee-ankle mobility exercises, and dynamic stretching of the quadriceps, hamstrings, and calf muscles. The main training section lasts approximately 30 minutes and includes exercises such as mini squats, wall squats, step-ups, step-downs, single-leg squats, and sit-to-stand tasks. While performing these exercises, participants observe their knee and hip alignment in the mirror, receive verbal corrections from the therapist, and in selected sessions view live movement feedback through the Kinect system.Training initially starts with 3 sets of 10 repetitions with 30–60 seconds of rest between sets. Exercises are performed within a pain-free or minimally painful range (VAS < 3). As participants progress, repetitions are increased to 15–20, resistance bands are added, squat depth is increased, and some exercises are performed on unstable surfaces.Visual feedback is provided through direct observation of lower-limb alignment in the mirror and through movement-angle analysis using Kinovea software. Auditory feedback is provided by the therapist using verbal cues such as “keep the knee aligned,” “stabilize the pelvis,” and “distribute your weight evenly.” Throughout the intervention, faded feedback principles are applied. In the early sessions, feedback is provided continuously, but over time the amount of verbal correction is gradually reduced to encourage self-monitoring and automatic motor control.

Category

Rehabilitation

2

Description

Dual-Task Training: Dual-task training is a rehabilitation approach in which participants simultaneously perform a motor task and a cognitive task. This intervention is designed to improve cognitive-motor integration, postural control, and movement automaticity during functional activities. In individuals with Patellofemoral Pain Syndrome, impaired motor control and increased attentional demands may contribute to pain and functional instability. Therefore, dual-task exercises are used to improve movement performance under conditions that more closely resemble daily-life activities.The equipment used for this intervention includes an interactive video projector, a Kinect motion sensor, balance boards, foam balance pads, cones and movement markers, a digital timer, cognitive-task presentation software, and speakers for auditory instructions.The intervention lasts for six weeks with three sessions per week, resulting in a total of 18 sessions. Each session lasts approximately 45 minutes. Prior to the intervention, participants attend a 60-minute familiarization session in which they are introduced to the basic motor exercises, cognitive tasks, and the Kinect and projector systems.Each session begins with a 5–7 minute warm-up including light walking, simple balance activities, and dynamic stretching exercises. The main training component lasts approximately 30 minutes and combines motor and cognitive activities simultaneously.Motor tasks include line walking, single-leg standing, controlled squatting, weight-shifting activities, and exercises performed on unstable surfaces. Cognitive tasks performed concurrently include backward counting, color naming, responding to visual stimuli, solving simple arithmetic problems, and short-term memory exercises such as number repetition.Training initially begins with 3 sets of 1-minute dual-task exercises with 30–60 seconds of rest between sets. As participants improve, the duration of the exercises is increased to 2–3 minutes, cognitive-task complexity is progressively increased, unstable surfaces are introduced, and additional visual or auditory stimuli are added to increase attentional demands.Throughout the intervention, pain intensity and fatigue are continuously monitored. Exercises are stopped if participants experience excessive pain or discomfort, and all activities are performed within a tolerable and safe movement range under therapist supervision.

Category

Rehabilitation

Recruitment centers

1

Recruitment center

Name of recruitment center

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Grant name
No specific grant
Grant code / Reference number
N/A
Is the source of funding the same sponsor organization/entity?
Yes
Title of funding source
Bagheiat-allah University of Medical Sciences
Proportion provided by this source
100
Public or private sector
Public
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
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Sharing plan

Deidentified Individual Participant Data Set (IPD)
Yes - There is a plan to make this available

Study Protocol
Yes - There is a plan to make this available

Statistical Analysis Plan
Yes - There is a plan to make this available

Informed Consent Form
Yes - There is a plan to make this available

Clinical Study Report
Yes - There is 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

Title and more details about the data/document
All documentation will be published in the form of a research article published in a reputable journal.

When the data will become available and for how long
After printing the article

To whom data/document is available
Universities and researchers

Under which criteria data/document could be used
Use for citation or review article

From where data/document is obtainable
Website of the publication that published the article

What processes are involved for a request to access data/document
The application must be official to the Vice Chancellor for Research of Baqiyatallah University of Medical Sciences.

Comments