Clinical Trial Protocol
Iranian Registry of Clinical Trials

23 Jul 2026

Effects of Aquatic Exercises on Knee proprioception and Altered Motor Control of the Knee Muscles after Anterior Cruciate Ligament Reconstruction

Protocol summary

Study aim
Determine the effects of aquatic exercise on knee proprioception and altered motor control of the knee muscles after anterior cruciate ligament reconstruction

Design
This study is a prospective, randomized, and controlled study. 38 subjects will be randomized into two groups: the hydrotherapy group (HT) and the land therapy group (LT)

Settings and conduct
This is a control clinical trial research. This research will be carried out at the Research Center of Rehabilitation Faculty and swimming pool of Tehran University of Medical Sciences. After selection of subjects that meet to the study criteria and giving proper explanations of the goals and methods of the study for patients, they will be asked to sign a consent form to participate in the study. Personal information will be collected by a questionnaire. After the randomization, subjects will be allocated into two intervention groups. Assessments including joint position sense, voluntary response index analysis and international knee documentation committee (IKDC) questionnaire will be used pre and post-test. The proprioception exercises applied in both groups will be identical in terms of type, intensity and duration.

Participants/Inclusion and exclusion criteria
Inclusion criteria: Subjects aged 18- 35 years, underwent a unilateral ACL reconstruction, ROM is greater than 100° flexion and complete extension and 9 weeks after ACL reconstruction؛ exclusion criteria: Contraindication to aquatic physiotherapy

Intervention groups
Hydrotherapy group (HT) and land therapy group (LT). Patients in the HT group will follow proprioception aquatic exercises training in water. While the patients in the LT group will follow proprioception exercises training on land.

Main outcome variables
active joint position sense؛ voluntary response index analysis using electromyography (EMG)

General information

Reason for update
Acronym
IRCT registration information
IRCT registration number: **IRCT20090301001722N21**
Registration date: **2019-11-09, 1398/08/18**
Registration timing: **prospective**

Last update: **2019-11-09, 1398/08/18**
Update count: **0**

Registration date
2019-11-09, 1398/08/18

Registrant information
Name
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Name of organization / entity
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Recruitment status
Recruitment complete
Funding source

Expected recruitment start date
2020-01-09, 1398/10/19
Expected recruitment end date
2021-01-09, 1399/10/20
Actual recruitment start date
empty

Actual recruitment end date
empty
Trial completion date
empty

Scientific title
Effects of Aquatic Exercises on Knee proprioception and Altered Motor Control of the Knee Muscles after Anterior Cruciate Ligament Reconstruction

Public title
Effects of Hydrotherapy on proprioception after Anterior Cruciate Ligament Reconstruction
Purpose
Treatment
Inclusion/Exclusion criteria
Inclusion criteria:
Aged between 18 and 35 years Undergone a unilateral ACL reconstruction No history or signs of injury in the contralateral knee 9 weeks after ACLR ROM is greater than 100° flexion and complete extension (zero degrees) Reconstruction using STG autograft No previous history of lower limb surgery before the lesion and absence of neurological disorders
Exclusion criteria:
Inability to understand and/or perform the required maneuvers fear of water uncontrolled epilepsy chlorine sensitivity infected open faecal incontinence myocardial infarction
Age
From **18 years** old to **35 years** old
Gender
Both

Phase
N/A
Groups that have been masked
No information
Sample size
Target sample size: **34**
Randomization (investigator's opinion)
Randomized
Randomization description
The patients will be randomly divided into two groups by a closed envelope method. The allocation of the subjects will be concealed by using sequentially numbered, sealed and opaque envelopes. On the first day of treatment, the envelope allocated will be opened by the participant
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
Ethics committee of Tehran University of Medical Sciences
Street address
6th floor, Tehran University of Medical Science building, Ghods Ave., Keshavarz blvd., Tehran, Iran
City
Tehran
Province
Tehran
Postal code
1417653761
Approval date
2019-09-29, 1398/07/07
Ethics committee reference number
IR.TUMS.VCR.REC.1398.571

Health conditions studied

1

Description of health condition studied
anterior cruciate ligament
ICD-10 code
S83.51
ICD-10 code description
Sprain of anterior cruciate ligament of knee

Primary outcomes

1

Description
knee joint position sense
Timepoint
pre and post-test
Method of measurement
Biodex Isokinetic System

2

Description
voluntary response index analysis
Timepoint
pre and post-test
Method of measurement
Surface EMG by Biometrics (Ltd) data Log

3

Description
knee function
Timepoint
pre and post-test
Method of measurement
international knee documentation committee questionnaire (IKDC)

Secondary outcomes

empty

Intervention groups

1

Description

Intervention group 1: hydrotherapy. All subjects will undergo 2 sessions of proprioception aquatic exercises for 6 weeks. Each hydrotherapy session will be last 30-45 minutes consisting of three parts: warm-up, main practice, and cooling down. The pool water temperature will be ranged from 28° to 30° C. During the exercises, the individual will be asked to remain at a depth where the water is between the waist and the sternum. The hydrotherapy intervention will be conducted in a professional swimming pool equipped with all needed equipment for aquatic exercises. The main exercises will be done according to individual ability and the patient's response to training. The progression of the training protocol as following: 1- Single leg stance with eyes open. 2- Single leg stance with eyes closed.3- Single leg stance with leg swing and eyes open. 4- Single leg stance with leg swing and eyes closed. 5- Single leg squat with eyes open. 6- Single leg squat with eyes closed.7- Rollover walking back and forth on Foam Roll. 8- Rollover walking forward with crossed arms.

Category

Rehabilitation

2

Description

Intervention group 2: land therapy. The proprioception exercises applied to land group will be identical in terms of type, intensity and duration to those exercises applied to hydrotherapy group. The leg that will undergo training is the injured leg and must be wearing a sneaker during the exercises, with the knee semi-flexed at approximately 30°. In addition, the individual will not be allowed to support by the contralateral limb or hands. If the subjects lost their balance, they will be asked to lean on the contralateral limb. All patients in both groups are going to begin the same conventional rehabilitation protocol according to evidence-based rehabilitation accelerated protocol by Van Grinsven 2010.

Category

Rehabilitation

Recruitment centers

1

Recruitment center

Name of recruitment center

Rehabilitation cilinic of Tehran University of Medical Science

Full name of responsible person

Dr Mohsen Mir

Street address

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Sponsors / Funding sources

1

Sponsor

Name of organization / entity

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Full name of responsible person

Mohammad Ali Sahraian, Vice chancellor for research of Tehran University of Medical Sciences

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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

Vice chancellor for research of Tehran 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

Name of organization / entity

Tehran University of Medical Sciences

Full name of responsible person

Mohammad Reza Hadian Rasanani

Position
Professor

Latest degree
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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