

A study protocol for objectively measuring knee recovery after anterior cruciate ligament reconstruction surgery: a biomechanical assessment technique

Submission date 19/04/2025	Recruitment status No longer recruiting	<input type="checkbox"/> Prospectively registered <input checked="" type="checkbox"/> Protocol
Registration date 29/04/2025	Overall study status Completed	<input checked="" type="checkbox"/> Statistical analysis plan <input type="checkbox"/> Results
Last Edited 28/04/2025	Condition category Musculoskeletal Diseases	<input type="checkbox"/> Individual participant data <input checked="" type="checkbox"/> Record updated in last year

Plain English summary of protocol

Background and study aims

Knee function assessment plays a pivotal role in the management and rehabilitation of patients with anterior cruciate ligament (ACL) injuries, but knee function assessment primarily relies on clinical rating scales, and their reliability is often compromised by inter-individual variability, assessor subjectivity, and dependence on clinical experience. This study protocol aims to explore the application of mechanical quantitative techniques in the postoperative rehabilitation assessment following anterior cruciate ligament reconstruction (ACLR).

Who can participate?

Adult patients with unilateral leg ACL injury, arthroscopic autologous hamstring or patellar tendon ACL reconstruction surgery, with no other ligamentous injuries involved

What does the study involve?

This study involves an objective mechanical quantitative technology evaluation of knee muscle tension in patients after ACLR surgery.

What are the possible benefits and risks of participating?

Objective and quantitative evaluation results of the knee joint can be obtained by participating in this study, and since there are no other intervention means, it is believed that there is no potential risk in this study.

Where is the study run from?

Hunan Provincial Rehabilitation Hospital, China

When is the study starting and how long is it expected to run for?

October 2024 to April 2025

Who is funding the study?
The Research Project of the Hunan Provincial Sports Bureau, China

Who is the main contact?
Dr Zhichun Zhu, lagged@126.com

Contact information

Type(s)

Public, Scientific, Principal investigator

Contact name

Dr Zhichun Zhu

ORCID ID

<https://orcid.org/0000-0001-9322-1491>

Contact details

No. 31, Yuhua lane, Yuhua District
Changsha City, Hunan Province
China
410021
+86 13548592933
lagged@126.com

Additional identifiers

Clinical Trials Information System (CTIS)

Nil known

Protocol serial number

Research Project of Hunan Provincial Sports Bureau: 2024KT0188

Study information

Scientific Title

Application of mechanical quantitative techniques in postoperative rehabilitation assessment of anterior cruciate ligament reconstruction: a study protocol

Study objectives

This study protocol aims to explore the application of mechanical quantitative techniques in the postoperative rehabilitation assessment following anterior cruciate ligament reconstruction (ACLR). ACL injuries are prevalent among athletes and pose a considerable threat to their careers. While ACLR remains the primary therapeutic intervention for such injuries, the assessment of postoperative rehabilitation still encounters significant challenges. Traditional assessment methods are limited by subjectivity and the absence of quantitative data. Mechanical quantitative techniques present a novel approach, offering objective and precise quantitative metrics for knee functional rehabilitation through the analysis of soft tissue mechanical properties.

Ethics approval required

Ethics approval required

Ethics approval(s)

approved 10/10/2024, Ethics Committee of Hunan Provincial Rehabilitation Hospital (No. 31, Yuhua lane, Yuhua District, Changsha City, Hunan Province, 410021, China; -; 524352104@qq.com), ref: -

Study design

Cross-sectional study

Primary study design

Observational

Study type(s)

Diagnostic

Health condition(s) or problem(s) studied

Quantitative assessment for muscle tension of the knee after ACLR

Interventions

BRIEF NAME: Mechanical Quantitative Techniques.

WHY: This study protocol aims to explore the application of mechanical quantitative techniques in the postoperative rehabilitation assessment following anterior cruciate ligament reconstruction (ACLR) and provide a scientific measurement tool for muscle tension.

WHAT: Use of a musculoskeletal mechanical quantitative detector (M5) to measure the mechanical quantitative characteristics (shear modulus G) of the subject's rectus femoris and hamstring muscles. And the information about the materials can be found at:<https://mp.weixin.qq.com/s/rJmYn8Yu-IFONFiqFXOIfQ>.

PROCEDURES: Firstly, clinical data will be collected from patients with anterior cruciate ligament injury to ensure sample diversity and representativeness. Secondly, quantitative measuring equipment is used to measure the knee joint and obtain relevant parameters. Strictly follow the operating procedures to ensure accurate and reliable data. Then, traditional rehabilitation assessment is conducted. Combining biomechanical methods, conducting in-depth data analysis to reveal the quantitative correlation between the degree of knee joint functional recovery and rehabilitation assessment results. Finally, a new clinical evaluation method is proposed and validated through evaluation.

WHO PROVIDED:

- a. Doctors: Major in rehabilitation medicine, with more than 10 years of working experience, and received training in medical statistics and ultrasonic testing.
- b. physiotherapist: Major in rehabilitation therapy technology, with more than 5 years' working experience, and received relevant training on knee joint function, sports injury rehabilitation.

HOW: The invention is supposed to be delivered face-to-face and will be provided individually.

WHERE: The inventions will occur at the hospital

WHEN AND HOW MUCH: For this research, all participants will be assessed 2 times, and the interval between the two assessments is supposed to be 12- 14 weeks.

TAILORING: This research is an observational study with no tailoring or modifications.

Intervention Type

Not Specified

Primary outcome(s)

Shear modulus of the knee muscle measured using Mechanical Quantitative Techniques at the beginning of the study (t2) and 12- 14 weeks after t2 (t4)

Key secondary outcome(s)

The range of knee motion, knee muscle strength, and knee function measured using traditional assessment methods and the Lysholm Knee Scoring Scale at the beginning of the study (t2) and 12- 14 weeks after t2 (t4)

Completion date

05/04/2026

Eligibility

Key inclusion criteria

1. Unilateral leg ACL injury, arthroscopic autologous hamstring or patellar tendon ACL reconstruction surgery, with no other ligamentous injuries involved
2. Swelling of the affected knee joint is grade 0 or 1+
3. Time from injury to surgery is less than 2 months
4. Ages between 18 and 60 years
5. Sign an informed consent form for rehabilitation treatment and actively cooperate with the treatment
6. The treatment plan is approved by the Ethics Committee of the Hunan Provincial Rehabilitation Hospital

Participant type(s)

Patient

Healthy volunteers allowed

No

Age group

Adult

Lower age limit

18 years

Upper age limit

60 years

Sex

All

Total final enrolment

72

Key exclusion criteria

1. Concurrent posterior cruciate ligament rupture or meniscal repair
2. Concurrent postoperative complications affecting limb exercise
3. Patients with a history of hip joint trauma
4. Individuals with hypertension, diabetes, or other chronic diseases of organs
5. Individuals with concurrent severe diseases of the heart, brain, kidneys, and hematopoietic system, and patients with mental illnesses
6. Concurrent with any conditions that are detrimental to patient recovery or continuation of the trial

Date of first enrolment

05/04/2025

Date of final enrolment

05/10/2025

Locations**Countries of recruitment**

China

Study participating centre**Hunan Provincial Rehabilitation Hospital**

No. 31, Yuhua lane, Yuhua District

Changsha City, Hunan Province

China

410021

Sponsor information**Organisation**

Hunan Sports Bureau

ROR

<https://ror.org/01351nn19>

Funder(s)**Funder type**

Research organisation

Funder Name

Hunan Sports Bureau

Results and Publications

Individual participant data (IPD) sharing plan

The data-sharing plans for the current study are unknown and will be made available at later date

IPD sharing plan summary

Data sharing statement to be made available at a later date

Study outputs

Output type	Details	Date created	Date added	Peer reviewed?	Patient-facing?
Protocol (other)		08/04/2025	22/04/2025	No	No
Statistical Analysis Plan			28/04/2025	No	No