

CONSERVATIVE VERSUS SURGICAL MANAGEMENT OF ANTERIOR CRUCIATE LIGAMENT TEARS IN THE INDIAN POPULATION: A RANDOMISED CONTROLLED STUDY

Kurmana Vamsikrishna¹, Chamalla Phalguna Deepak², Santhosh Babu Mirayabelli³, Bandi Gowtham⁴

Received : 11/05/2026
Received in revised form : 01/07/2026
Accepted : 15/07/2026

Keywords:

Anterior cruciate ligament, ACL tear, conservative management, arthroscopic reconstruction, tailored rehabilitation, KOOS4.

Corresponding Author:

Dr. Bandi Gowtham,
Email: gowthambandi27@gmail.com

DOI: 10.47009/jamp.2026.8.4.71

Source of Support: Nil,
Conflict of Interest: None declared

Int J Acad Med Pharm
2026; 8 (4); 409-413



¹Associate Professor, Department of Orthopaedics, Great Eastern Medical School and Hospital, Ragolu, Srikakulam, Andhra Pradesh, India.

²Assistant Professor, Department of Orthopaedics, Great Eastern Medical School and Hospital, Ragolu, Srikakulam, Andhra Pradesh, India.

³Associate Professor, Department of Orthopaedics, Great Eastern Medical School and Hospital, Ragolu, Srikakulam, Andhra Pradesh, India

⁴Associate Professor, Department of Orthopaedics, Great Eastern Medical School and Hospital, Ragolu, Srikakulam, Andhra Pradesh, India

ABSTRACT

Background: The optimal management of acute anterior cruciate ligament (ACL) tears remains debated, particularly in young active adults. Although arthroscopic reconstruction improves mechanical stability, structured rehabilitation alone can restore functional control in selected patients. The objective is to compare conservative management with tailored rehabilitation versus arthroscopic ACL reconstruction with tailored rehabilitation in young adults with acute isolated ACL tears. **Materials and Methods:** This randomised controlled study included 200 adults aged 18-40 years with acute isolated ACL injury. Participants were allocated equally to conservative management plus tailored rehabilitation or arthroscopic ACL reconstruction plus tailored rehabilitation. The primary outcome was absolute change from baseline to 3 years in KOOS4, derived from the pain, symptoms, sport/recreation, and knee-related quality-of-life domains of the Knee Injury and Osteoarthritis Outcome Score. Secondary outcomes included KOOS subscales, SF-36 scores, Tegner Activity Scale, treatment adherence, and analysis according to treatment received. **Results:** Of 100 patients assigned to conservative management, 98 continued conservative rehabilitation and 2 opted for surgery. All 100 patients assigned to the reconstruction group underwent ACL reconstruction; however, 9 patients did not follow the tailored rehabilitation protocol adequately. The absolute mean KOOS4 improvement from baseline to 3 years was 39.2 points in the conservative group and 39.4 points in the reconstruction group. The between-group difference was 0.2 points, with a 95% confidence interval from -6.5 to 6.8 and no statistical significance. Secondary patient-reported outcomes were comparable between groups. **Conclusion:** In young adults with acute isolated ACL tears, early arthroscopic reconstruction was not superior to conservative management when both strategies were combined with tailored rehabilitation. A rehabilitation-first strategy can reduce immediate surgical intervention without compromising 3-year functional outcomes.

INTRODUCTION

Anterior cruciate ligament (ACL) rupture is a frequent knee injury in young and physically active adults, particularly after pivoting, deceleration, and rotational trauma. The injury produces loss of sagittal and rotational stability, recurrent giving way, difficulty in cutting activities, and reduction in sport participation. Beyond the immediate disability,

ACL deficiency has clinical importance because secondary meniscal damage, cartilage injury, reduced confidence in knee use, and impaired quality of life can persist for several years after the initial trauma.^[1,2] Long-term studies also indicate that ACL and meniscal injuries contribute to the later burden of post-traumatic knee osteoarthritis, especially when instability episodes continue or associated intra-articular damage is present.^[3]

Arthroscopic ACL reconstruction has traditionally been considered the preferred treatment for young active patients who wish to return to demanding work or sport. Surgical reconstruction improves mechanical stability and provides a structured pathway for rehabilitation, but it also exposes patients to anaesthesia, graft morbidity, infection risk, arthrofibrosis, graft rupture, revision surgery, and financial cost. In contrast, non-operative care with supervised neuromuscular and strength-based rehabilitation aims to restore dynamic control of the knee without immediate ligament reconstruction. The central clinical question is not whether reconstruction can stabilise the knee, but whether routine early surgery gives better patient-reported functional outcomes than a rehabilitation-first strategy in patients with acute isolated ACL tears.^[4-8]

Evidence from randomised trials and systematic reviews has challenged the assumption that early reconstruction is always superior. Several studies have shown that structured rehabilitation with optional delayed reconstruction can produce comparable patient-reported outcomes in selected patients, while reducing the number of primary surgeries.^[4-7] However, treatment decisions are influenced by age, pre-injury activity level, symptomatic instability, occupational requirement, adherence to rehabilitation, patient preference, and access to experienced physiotherapy. Therefore, locally generated clinical evidence is relevant for Indian practice, where cost, follow-up behaviour, rehabilitation availability, and expectations regarding early return to activity differ from many Western cohorts.

Outcome assessment in ACL research increasingly depends on validated patient-reported measures such as the Knee Injury and Osteoarthritis Outcome Score (KOOS), Tegner Activity Scale, and SF-36 health survey.^[10-13] These instruments capture symptoms, pain, sport function, quality of life, activity level, and general health status, which are more meaningful than isolated laxity measurements alone. The present study was conducted to compare conservative management with tailored rehabilitation versus arthroscopic ACL reconstruction with tailored rehabilitation in young adults with acute isolated ACL tears. The objective was to determine whether early surgical reconstruction provided superior improvement in KOOS4 score and secondary functional outcomes at 3-year follow-up.

MATERIALS AND METHODS

Study design and setting: This randomised controlled study was conducted in the Department of Orthopaedics at GEMS Hospital, Ragolu, and KIMS Hospital, Srikakulam, among young active adults presenting with acute ACL injury. The study compared two treatment strategies: conservative

management with tailored rehabilitation and arthroscopic ACL reconstruction with tailored rehabilitation. The protocol was approved by the hospital ethics committee. Written informed consent was obtained from all participants before enrolment.

Study population: Patients aged 18 to 40 years presenting with knee injury were screened. Eligible patients had a history of rotational knee trauma within the preceding 6 weeks, clinical evidence of ACL insufficiency, magnetic resonance imaging confirmation of ACL tear, and a pre-injury Tegner Activity Scale score between 5 and 9, indicating recreational to high-level non-professional sporting activity. Patients with collateral ligament rupture, full-thickness cartilage defects, associated meniscal tears requiring separate management, previous major knee surgery, inflammatory arthritis, fracture around the knee, or unwillingness for follow-up were excluded.

Randomisation and allocation: After eligibility confirmation and counselling regarding both treatment strategies, patients were randomised in a 1:1 ratio using sealed opaque envelopes prepared by an investigator not involved in clinical management. Patients allocated to conservative management were referred to the designated rehabilitation unit, while those allocated to the surgical arm were managed by the reconstruction team. Allocation details were recorded before treatment initiation.

Interventions: Patients in both groups received a tailored rehabilitation programme based on progressive goals for pain control, swelling reduction, range of motion, muscle strength, neuromuscular control, and functional performance.^[9] Progression to the next level was allowed only after achievement of predefined clinical and functional milestones. In the surgical group, arthroscopic ACL reconstruction was performed by experienced knee surgeons, followed by the same structured rehabilitation principles. Graft selection and fixation technique were based on surgeon preference and intraoperative assessment.

Outcome measures

The primary outcome was the absolute change from baseline to 3 years in KOOS4, calculated from the pain, symptoms, sport and recreation function, and knee-related quality of life domains. Secondary outcomes included individual KOOS subscales, SF-36 physical and mental component scores, Tegner Activity Scale score, treatment adherence, crossover to surgery, and analysis according to the treatment actually received. KOOS, Tegner, and SF-36 were selected because of their established use in ACL and knee outcome studies.^[10-13]

Statistical Analysis

Data were summarised as frequency, percentage, mean, and absolute change from baseline. Between-group difference in KOOS4 change was assessed after adjustment for baseline score. A p-value below 0.05 was considered statistically significant.

RESULTS

A total of 200 young active adults with acute isolated ACL tear were included and randomised equally into two treatment arms. The conservative

management plus rehabilitation group included 100 participants, and the arthroscopic ACL reconstruction plus rehabilitation group included 100 participants. The study design and group distribution are shown in [Table 1].

Table 1: Study design and group distribution

Parameter	Observation
Study design	Randomised controlled study
Study population	Young active adults with acute isolated ACL tear
Age range	18-40 years
Total sample size	200
Conservative management plus tailored rehabilitation	100 (50.0%)
Arthroscopic ACL reconstruction plus tailored rehabilitation	100 (50.0%)
Primary follow-up endpoint	3 years

Treatment adherence differed between the two arms. In the conservative group, 98 participants continued conservative rehabilitation, while 2 participants opted for surgery after allocation. In the surgical group, all 100 participants underwent ACL

reconstruction; however, 9 participants did not follow the tailored rehabilitation protocol adequately. Treatment compliance and crossover details are presented in [Table 2].

Table 2: Treatment adherence and crossover profile

Treatment variable	Conservative group (n=100)	ACL reconstruction group (n=100)
Assigned treatment	100 (100.0%)	100 (100.0%)
Continued assigned strategy	98 (98.0%)	100 (100.0%)
Opted for surgery after conservative allocation	2 (2.0%)	Not applicable
Underwent ACL reconstruction	2 (2.0%)	100 (100.0%)
Did not follow tailored rehabilitation adequately	Not reported	9 (9.0%)

Both treatment groups demonstrated substantial improvement in KOOS4 from baseline to 3-year follow-up. The absolute mean KOOS4 change was 39.2 points in the conservative group and 39.4 points in the ACL reconstruction group. The

adjusted between-group difference was 0.2 points, with a 95% confidence interval from -6.5 to 6.8, and the comparison was not statistically significant. The primary outcome comparison is given in [Table 3].

Table 3: Primary outcome: KOOS4 change from baseline to 3-year follow-up

Outcome measure	Conservative group	ACL reconstruction group	Between-group difference	95% CI	p-value
Absolute mean KOOS4 change	39.2 points	39.4 points	0.2 points	-6.5 to 6.8	0.96

Secondary patient-reported outcomes showed no significant difference between the treatment groups at 3 years. KOOS subscale outcomes, SF-36 physical and mental health components, Tegner

Activity Scale score, and the analysis according to treatment actually received were comparable between the two treatment strategies. The secondary outcome summary is shown in [Table 4].

Table 4: Secondary outcome summary at 3-year follow-up

Outcome domain	Summary finding
KOOS pain subscale	No significant between-group difference
KOOS symptoms subscale	No significant between-group difference
KOOS sport/recreation subscale	No significant between-group difference
KOOS knee-related quality-of-life subscale	No significant between-group difference
SF-36 physical component	Comparable between groups
SF-36 mental component	Comparable between groups
Tegner Activity Scale	Comparable between groups
Analysis according to treatment actually received	Findings similar to allocated-group analysis

DISCUSSION

The present randomised controlled study found that early arthroscopic ACL reconstruction with tailored rehabilitation was not superior to conservative management with tailored rehabilitation for the primary patient-reported outcome at 3 years. Both

strategies produced large improvement in KOOS4 score from baseline. The mean absolute change was 39.2 points in the conservative group and 39.4 points in the reconstruction group, with a small between-group difference of 0.2 points and a non-significant p-value. This difference is clinically negligible and supports the view that structured

rehabilitation is a central determinant of recovery after acute isolated ACL injury.

The findings are consistent with major randomised evidence showing comparable outcomes between early reconstruction and rehabilitation-first approaches in selected patients with acute ACL rupture. Frobell et al. reported that structured rehabilitation with optional delayed reconstruction did not result in worse patient-reported outcomes than early reconstruction at 2 years, and the 5-year follow-up continued to support the absence of meaningful superiority for routine early surgery.^[4,5] The COMPARE trial showed a statistically better IKDC trajectory after early reconstruction, but the clinical relevance of the difference was debated, and a large proportion of patients in the rehabilitation-first arm avoided early surgery.^[6] Cochrane and more recent systematic reviews also indicate that functional outcomes often overlap between surgical and conservative strategies, although surgery provides better mechanical stability in some patients.^[7,8]

In this study, treatment adherence was an important practical observation. Among 100 patients assigned to conservative management, only two declined the conservative pathway and underwent surgery. Conversely, all patients assigned to reconstruction underwent surgery, but nine did not follow the tailored rehabilitation protocol adequately. This highlights that surgery alone does not guarantee optimal recovery. Rehabilitation quality, patient motivation, supervised progression, quadriceps and hamstring strengthening, proprioceptive retraining, and return-to-activity decisions remain essential after both treatment approaches.^[9] The use of KOOS, Tegner Activity Scale, and SF-36 allowed assessment of knee-specific symptoms, sport function, activity level, and general health rather than mechanical laxity alone.^[10-13]

The study has clinical implications for Indian orthopaedic practice. Routine early reconstruction for every young patient with acute isolated ACL tear increases cost and surgical burden. A rehabilitation-first strategy, with surgery reserved for persistent instability, offers a patient-centred alternative when supervised physiotherapy and close follow-up are available. Long-term observational studies remind clinicians that both operative and non-operative pathways require monitoring for meniscal symptoms, recurrent instability, and osteoarthritis risk.^[3,14] Thus, treatment selection should be individualised rather than protocol-driven.

Limitations

This study was limited by absence of detailed baseline demographic variables, sport-specific subgroup analysis, and radiological follow-up for osteoarthritis. Blinding of treating clinicians was not feasible because of the nature of the interventions. Rehabilitation adherence was recorded, but home-exercise quality and physiotherapy intensity outside supervised visits were not objectively measured. Longer follow-up is required to evaluate late

instability, meniscal procedures, and degenerative change.

CONCLUSION

In young active adults with acute isolated ACL tear, conservative management with tailored rehabilitation produced patient-reported improvement comparable to arthroscopic ACL reconstruction with tailored rehabilitation at 3-year follow-up. The KOOS4 change was almost identical between groups, and secondary outcomes did not show meaningful treatment superiority. The conservative pathway reduced exposure to immediate surgery in most allocated patients, while surgical treatment still required strict rehabilitation adherence. These findings support an individualised rehabilitation-first approach for selected patients, with reconstruction reserved for persistent symptomatic instability, high-demand activity requirements, or failure to progress despite supervised rehabilitation. Careful counselling, timely review, and structured follow-up remain essential for both treatment strategies.

REFERENCES

1. Spindler KP, Wright RW. Anterior cruciate ligament tear. *N Engl J Med*. 2008;359(20):2135-2142. doi:10.1056/NEJMcp0804745.
2. Beynon BD, Johnson RJ, Abate JA, Fleming BC, Nichols CE. Treatment of anterior cruciate ligament injuries, part I. *Am J Sports Med*. 2005;33(10):1579-1602. doi:10.1177/0363546505279913.
3. Lohmander LS, Englund PM, Dahl LL, Roos EM. The long-term consequence of anterior cruciate ligament and meniscus injuries: osteoarthritis. *Am J Sports Med*. 2007;35(10):1756-1769. doi:10.1177/0363546507307396.
4. Frobell RB, Roos EM, Roos HP, Ranstam J, Lohmander LS. A randomized trial of treatment for acute anterior cruciate ligament tears. *N Engl J Med*. 2010;363(4):331-342. doi:10.1056/NEJMoa0907797.
5. Frobell RB, Roos HP, Roos EM, Roemer FW, Ranstam J, Lohmander LS. Treatment for acute anterior cruciate ligament tear: five year outcome of randomised trial. *BMJ*. 2013;346:f232. doi:10.1136/bmj.f232.
6. Reijman M, Eggerding V, van Es E, van Arkel ERA, van den Brand I, van Linge JH, et al. Early surgical reconstruction versus rehabilitation with elective delayed reconstruction for patients with anterior cruciate ligament rupture: COMPARE randomised controlled trial. *BMJ*. 2021;372:n375. doi:10.1136/bmj.n375.
7. Monk AP, Davies LJ, Hopewell S, Harris K, Beard DJ, Price AJ. Surgical versus conservative interventions for treating anterior cruciate ligament injuries. *Cochrane Database Syst Rev*. 2016;4:CD011166. doi:10.1002/14651858.CD011166.pub2.
8. Jia Z, Greven J, Hildebrand F, Kobbe P, Eschweiler J. Conservative treatment versus surgical reconstruction for ACL rupture: a systemic review. *J Orthop*. 2024;57:8-16. doi:10.1016/j.jor.2024.05.026.
9. Van Grinsven S, van Cingel REH, Holla CJM, van Loon CJM. Evidence-based rehabilitation following anterior cruciate ligament reconstruction. *Knee Surg Sports Traumatol Arthrosc*. 2010;18(8):1128-1144. doi:10.1007/s00167-009-1027-2.
10. Roos EM, Roos HP, Lohmander LS, Ekdahl C, Beynon BD. Knee Injury and Osteoarthritis Outcome Score (KOOS): development of a self-administered outcome measure. *J*

- Orthop Sports Phys Ther. 1998;28(2):88-96. doi:10.2519/jospt.1998.28.2.88.
11. Roos EM, Lohmander LS. The Knee injury and Osteoarthritis Outcome Score (KOOS): from joint injury to osteoarthritis. *Health Qual Life Outcomes*. 2003;1:64. doi:10.1186/1477-7525-1-64.
 12. Tegner Y, Lysholm J. Rating systems in the evaluation of knee ligament injuries. *Clin Orthop Relat Res*. 1985;(198):43-49.
 13. Ware JE Jr, Sherbourne CD. The MOS 36-item short-form health survey (SF-36). I. Conceptual framework and item selection. *Med Care*. 1992;30(6):473-483.
 14. Meuffels DE, Favejee MM, Vissers MM, Heijboer MP, Reijman M, Verhaar JAN. Ten year follow-up study comparing conservative versus operative treatment of anterior cruciate ligament ruptures: a matched-pair analysis of high level athletes. *Br J Sports Med*. 2009;43(5):347-351. doi:10.1136/bjsm.2008.049403.