

Comparative Study of Functional and Clinical Outcomes of All-Inside Versus Conventional Arthroscopic Anterior Cruciate Ligament Reconstruction

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DOI: <https://doi.org/10.5281/zenodo.23424173>

Received: 11 July 2026, Revised: 13 August 2026, Accepted: 16 September 2026, Online First: 16 October 2026

ABSTRACT

Background: Anterior cruciate ligament (ACL) injuries commonly affect young, physically active individuals and may lead to knee instability and functional impairment. All-inside arthroscopic ACL reconstruction has emerged as an alternative to conventional reconstruction, potentially offering reduced postoperative morbidity and improved early recovery. **Aim:** To compare the functional and clinical outcomes of all-inside versus conventional arthroscopic ACL reconstruction. **Materials and Methods:** This prospective comparative study included 70 patients with ACL injuries, divided into Group A (all-inside reconstruction, n = 35) and Group B (conventional reconstruction, n = 35). Patients were evaluated for operative parameters, postoperative pain using the Visual Analogue Scale (VAS), knee range of motion, Lysholm and International Knee Documentation Committee (IKDC) scores, clinical knee stability, and postoperative complications over 6 months. **Results:** Operative duration was longer in Group A (78.4 ± 12.6 versus 69.2 ± 11.8 minutes; $p = 0.002$), whereas blood loss was significantly lower (42.6 ± 12.4 versus 55.8 ± 15.2 mL; $p < 0.001$). Group A demonstrated significantly lower VAS scores at 2 weeks (2.8 ± 0.9 versus 3.5 ± 1.0 ; $p = 0.003$). At 6 months, Lysholm scores (91.2 ± 5.8 versus 88.4 ± 6.5 ; $p = 0.061$) and IKDC scores (88.6 ± 6.2 versus 85.8 ± 6.8 ; $p = 0.077$) were comparable. Postoperative complications occurred in 14.3% and 25.7% of patients, respectively ($p = 0.232$). **Conclusion:** Both techniques demonstrated satisfactory functional outcomes and knee stability. All-inside reconstruction showed potential advantages in early postoperative recovery, although 6-month functional outcomes were comparable.

Keywords: Anterior cruciate ligament; All-inside ACL reconstruction; Conventional ACL reconstruction; Arthroscopy; Lysholm score; IKDC score; Knee stability.

INTRODUCTION

The anterior cruciate ligament (ACL) is one of the principal stabilizing structures of the knee joint, responsible for restricting anterior translation of the tibia relative to the femur and maintaining rotational stability [1]. ACL injuries are common among young, physically active individuals, particularly athletes participating in sports involving sudden deceleration, pivoting, jumping, and rapid changes in direction. The annual incidence of ACL injuries has been estimated at approximately 1 in 3,000 individuals, with more than 175,000 cases reported annually in the United States [2]. ACL rupture may result in recurrent knee instability, impaired

functional performance, and reduced participation in sporting activities. Persistent instability can also increase the risk of secondary meniscal injuries, articular cartilage damage, and progressive degenerative changes [3–6].

Arthroscopic ACL reconstruction is an established surgical intervention for patients with symptomatic ACL deficiency, particularly those experiencing recurrent instability or wishing to return to demanding physical activities [7]. The primary objectives of reconstruction are to restore knee stability, improve functional performance, and facilitate a safe return to preinjury activity levels. Conventional arthroscopic ACL

reconstruction involves the creation of complete bone tunnels for graft placement and fixation. Although this technique provides satisfactory clinical outcomes, concerns regarding postoperative pain, donor-site morbidity, tunnel widening, and graft-related complications have encouraged the development of alternative surgical approaches [8].

The all-inside ACL reconstruction technique has emerged as a minimally invasive modification of conventional reconstruction. Unlike conventional techniques, it utilizes closed-ended femoral and tibial sockets rather than complete bone tunnels, thereby preserving bone stock and reducing surgical disruption [8,9]. The technique commonly employs a quadrupled semitendinosus tendon autograft with cortical suspensory fixation on both sides, allowing preservation of the gracilis tendon and potentially reducing donor-site morbidity [10]. Additional proposed advantages include smaller incisions, reduced early postoperative pain, and improved postoperative comfort [11–15].

Previous comparative studies have demonstrated satisfactory functional and clinical outcomes following both techniques. Goyal et al. [16] reported reduced early postoperative pain with all-inside reconstruction while achieving functional outcomes comparable to conventional ACL reconstruction. However, evidence regarding differences in postoperative knee stability, functional recovery, graft failure, and complications remains inconclusive. Variations in graft selection, fixation methods, rehabilitation protocols, and follow-up duration further complicate comparisons between these techniques.

Therefore, the present study, entitled “A Comparative Study of Functional and Clinical Outcomes of All-Inside Versus Conventional Arthroscopic Anterior Cruciate Ligament Reconstruction,” was undertaken to compare postoperative functional recovery, clinical knee stability, pain, range of motion, and procedure-related complications between the two techniques. The findings may help determine their relative effectiveness and contribute to evidence-based selection of surgical techniques for ACL reconstruction.

MATERIALS AND METHODS

Study Design

The present study was designed as a prospective, hospital-based, comparative observational study to evaluate the functional and clinical outcomes of all-inside versus conventional arthroscopic anterior cruciate ligament (ACL) reconstruction.

Study Setting

The study was conducted in the Department of Orthopaedics at a tertiary care teaching hospital. Patients diagnosed with ACL injuries who underwent

arthroscopic ACL reconstruction were included in the study.

Study Duration

The study was conducted over a period of 18 months, during which eligible patients were enrolled, surgically treated, and followed up to assess postoperative functional and clinical outcomes.

Sample Size

A total of 70 patients with ACL injuries who fulfilled the eligibility criteria were included in the study. The patients were divided into two groups according to the surgical technique used.

- Group A (n = 35): Patients who underwent all-inside arthroscopic ACL reconstruction.
- Group B (n = 35): Patients who underwent conventional arthroscopic ACL reconstruction.

Sampling Technique

A consecutive sampling technique was employed. Patients fulfilling the inclusion and exclusion criteria were enrolled until the required sample size was achieved. The choice of surgical technique was based on the treating surgeon's clinical assessment and the patient's surgical requirements.

Inclusion Criteria

1. Patients aged 18–50 years.
2. Patients diagnosed with complete ACL rupture based on clinical examination and magnetic resonance imaging (MRI).
3. Patients presenting with symptomatic knee instability requiring surgical reconstruction.
4. Patients undergoing primary arthroscopic ACL reconstruction.
5. Patients willing to participate in the study and provide written informed consent.
6. Patients willing to comply with the prescribed postoperative rehabilitation and follow-up schedule.

Exclusion Criteria

1. Patients with previous ACL reconstruction or revision ACL surgery.
2. Patients with multiligamentous knee injuries requiring additional ligament reconstruction.
3. Patients with advanced osteoarthritis or significant degenerative changes of the knee.
4. Patients with associated fractures involving the knee joint.
5. Patients with active infection or inflammatory arthropathy affecting the knee.
6. Patients with neurological or neuromuscular disorders affecting lower-limb function.

7. Patients who were unwilling to participate or unable to complete the follow-up assessments.

Ethical Considerations

Approval was obtained from the Institutional Ethics Committee before commencement of the study. Written informed consent was obtained from all participants after explaining the study objectives, surgical procedures, potential complications, and follow-up requirements. Patient confidentiality was maintained throughout the study.

Preoperative Assessment

All enrolled patients underwent a detailed preoperative evaluation, including demographic characteristics, medical history, mechanism of injury, duration of symptoms, and functional limitations.

Clinical examination included assessment of knee swelling, tenderness, range of motion, and ligamentous stability using the Lachman test, anterior drawer test, and pivot-shift test. MRI of the affected knee was performed to confirm ACL rupture and identify associated meniscal or chondral injuries.

Baseline functional status was assessed using the Lysholm Knee Scoring Scale and International Knee Documentation Committee (IKDC) subjective knee evaluation score. Preoperative pain was assessed using the Visual Analogue Scale (VAS).

Surgical Procedure

All surgical procedures were performed under spinal or general anaesthesia using standard arthroscopic techniques. Patients were positioned supine, and appropriate aseptic precautions were maintained. Diagnostic arthroscopy was performed to evaluate the ACL tear and identify associated intra-articular injuries.

Group A: All-Inside Arthroscopic ACL Reconstruction (n = 35)

Patients allocated to Group A underwent all-inside arthroscopic ACL reconstruction. The semitendinosus tendon was harvested and prepared as a quadrupled autograft of appropriate length and diameter.

The femoral and tibial anatomical ACL footprints were identified arthroscopically. Closed-ended femoral and tibial sockets were prepared using retrograde drilling instruments. The prepared graft was introduced into the sockets and secured using cortical suspensory fixation devices on both the femoral and tibial sides.

Adequate graft tension and positioning were confirmed arthroscopically. Knee stability and graft impingement were assessed before completion of the procedure.

Group B: Conventional Arthroscopic ACL Reconstruction (n = 35)

Patients allocated to Group B underwent conventional arthroscopic ACL reconstruction using a hamstring tendon autograft.

The semitendinosus and gracilis tendons were harvested and prepared according to the required graft diameter and length. Complete tibial and femoral bone tunnels were created at the anatomical ACL attachment sites using standard arthroscopic drilling techniques.

The prepared graft was passed through the tunnels and secured using appropriate fixation devices. Graft tension, positioning, and knee stability were assessed before wound closure.

Postoperative Management and Rehabilitation

All patients received standardized postoperative care, including analgesics, antibiotic prophylaxis, wound care, and physiotherapy.

A structured rehabilitation protocol was followed in both groups to minimize differences related to postoperative management. Early rehabilitation included quadriceps strengthening, ankle pump exercises, and gradual restoration of knee range of motion.

Weight-bearing activities were progressively introduced according to postoperative recovery, knee stability, and associated intra-articular injuries. Subsequent rehabilitation focused on muscle strengthening, proprioceptive training, gait correction, and gradual return to functional activities.

Follow-Up Assessment

Patients were evaluated at scheduled postoperative intervals of 2 weeks, 6 weeks, 3 months, and 6 months.

At each follow-up visit, clinical recovery, pain, knee range of motion, stability, and postoperative complications were assessed. Functional outcomes were evaluated using standardized scoring systems.

Functional Outcome Assessment

Functional outcomes were assessed using the following parameters:

1. Lysholm Knee Scoring Scale

The Lysholm score was used to assess knee function based on pain, instability, locking, swelling, limping, stair climbing, squatting, and use of support. Scores ranged from 0 to 100, with higher scores indicating better knee function.

Functional outcomes were categorized as:

Lysholm score	Functional outcome
95–100	Excellent
84–94	Good
65–83	Fair
<65	Poor

2. International Knee Documentation Committee (IKDC) Score

The IKDC subjective knee evaluation score was used to assess symptoms, functional limitations, and participation in daily and sporting activities. Scores ranged from 0 to 100, with higher scores representing better functional outcomes.

3. Visual Analogue Scale (VAS)

Postoperative pain was assessed using the VAS, ranging from 0 to 10, where 0 indicated no pain and 10 indicated the worst imaginable pain.

Clinical Outcome Assessment

Clinical outcomes were evaluated using the following parameters:

1. Lachman test: Assessment of anterior knee instability.
2. Anterior drawer test: Evaluation of anterior tibial translation.
3. Pivot-shift test: Assessment of rotational knee stability.
4. Range of motion: Measurement of knee flexion and extension using a goniometer.
5. Postoperative complications: Assessment of surgical-site infection, knee stiffness, graft failure, persistent instability, and other procedure-related complications.

Outcome Measures

Primary Outcome Measures

The primary outcomes were the differences in postoperative functional recovery between the all-inside and conventional ACL reconstruction groups, assessed using:

- Lysholm Knee Scoring Scale at 6 months.
- IKDC subjective knee evaluation score at 6 months.

Secondary Outcome Measures

The secondary outcomes included postoperative pain measured using VAS, clinical knee stability assessed by Lachman, anterior drawer, and pivot-shift tests, postoperative range of motion, operative duration, and procedure-related complications.

Data Collection

All demographic, clinical, operative, and postoperative data were recorded in a structured case record form. Information included age, sex, body mass index, affected side, mode of injury, duration of symptoms, surgical technique, operative duration, baseline functional scores, and follow-up findings.

The collected data were entered into a Microsoft Excel spreadsheet and subsequently analyzed using appropriate

Statistical Methods.

Statistical Analysis

Data were analyzed using SPSS 27 statistical software. Continuous variables were expressed as mean $\pm$ standard deviation or median with interquartile range, depending on their distribution, whereas categorical variables were presented as frequencies and percentages.

Normality of continuous data was assessed using the Shapiro–Wilk test. Comparisons between the two groups were performed using the independent-samples Student's t-test for normally distributed variables and the Mann–Whitney U test for non-normally distributed variables.

Categorical variables were compared using the Chi-square test or Fisher's exact test, as SPSS 27. Within-group changes in functional scores from baseline to postoperative follow-up were assessed using the paired t-test or Wilcoxon signed-rank test. Repeated assessments were evaluated using SPSS 27 repeated-measures methods.

A p-value <0.05 was considered statistically significant.

RESULTS

A total of 70 patients undergoing arthroscopic anterior cruciate ligament (ACL) reconstruction were included in the study. Patients were equally divided into two groups: Group A comprised 35 patients who underwent all-inside ACL reconstruction, while Group B comprised 35 patients who underwent conventional arthroscopic ACL reconstruction. Demographic characteristics, intraoperative parameters, postoperative pain, knee range of motion, functional outcomes, clinical knee stability, postoperative complications, and recovery parameters were compared between the two groups over a follow-up period of six months.

Table 1. Comparison of Demographic and Baseline Clinical Characteristics Between the Two Groups (N = 70)

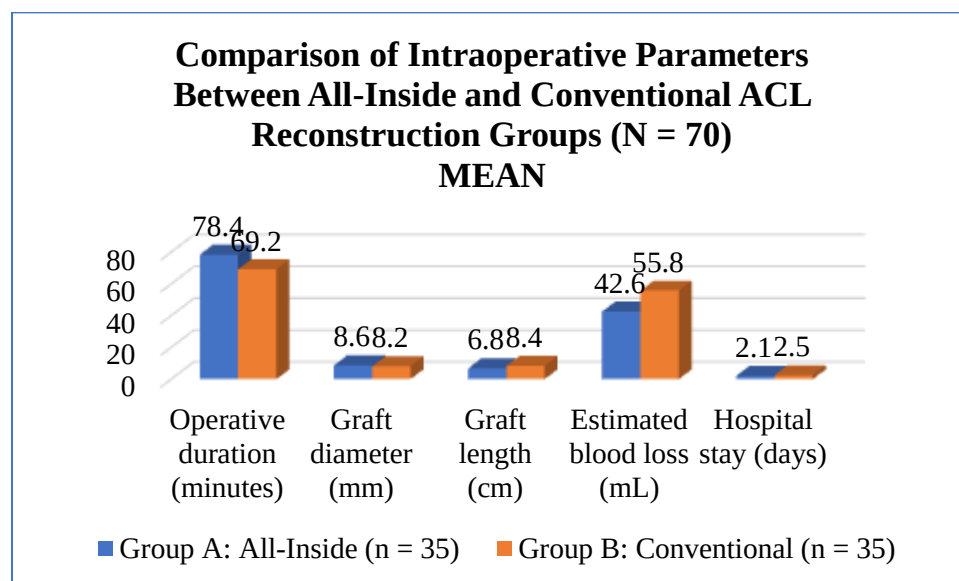
Parameter	Group A: All-Inside (n = 35)	Group B: Conventional (n = 35)	p-value
Age (years), Mean $\pm$ SD	28.6 $\pm$ 6.4	29.2 $\pm$ 7.1	0.712
Age group, n (%)			0.925
18–25 years	13 (37.1)	12 (34.3)	
26–35 years	16 (45.7)	16 (45.7)	
36–50 years	6 (17.1)	7 (20.0)	

Sex, n (%)			0.785
Male	27 (77.1)	26 (74.3)	
Female	8 (22.9)	9 (25.7)	
BMI (kg/m ²), Mean $\pm$ SD	24.3 $\pm$ 2.8	24.7 $\pm$ 3.1	0.573
Affected side, n (%)			0.810
Right	19 (54.3)	18 (51.4)	
Left	16 (45.7)	17 (48.6)	
Mode of injury, n (%)			0.905
Sports-related injury	22 (62.9)	21 (60.0)	
Road traffic accident	8 (22.9)	9 (25.7)	
Fall/other injury	5 (14.3)	5 (14.3)	
Duration of injury (months), Mean $\pm$ SD	7.8 $\pm$ 3.2	8.1 $\pm$ 3.5	0.709
Preoperative Lysholm score	52.4 $\pm$ 8.6	51.8 $\pm$ 9.1	0.778
Preoperative IKDC score	48.6 $\pm$ 7.9	47.9 $\pm$ 8.2	0.717
Preoperative VAS score	5.8 $\pm$ 1.2	5.9 $\pm$ 1.3	0.739

As shown in Table 1, the mean age of patients was 28.6 ± 6.4 years in Group A and 29.2 ± 7.1 years in Group B ($p=0.712$). Most patients belonged to the 26–35-year age group (45.7% in both groups). Male predominance was observed in both groups (77.1% and 74.3%, respectively). The mean BMI was 24.3 ± 2.8 kg/m² in Group A and 24.7 ± 3.1 kg/m² in Group B ($p=0.573$). Sports-related injuries were the most common mode of injury, accounting for 62.9% and 60.0% of cases, respectively. The mean duration of injury was 7.8 ± 3.2 months in Group A and 8.1 ± 3.5 months in Group B. Preoperative Lysholm, IKDC, and VAS scores were comparable between the groups, with no statistically significant differences ($p>0.05$). Overall, both groups were comparable regarding demographic and baseline clinical characteristics.

Table 2. Comparison of Intraoperative Parameters Between All-Inside and Conventional ACL Reconstruction Groups (N = 70)

Parameter	Group A: All-Inside (n = 35)	Group B: Conventional (n = 35)	p-value
Operative duration (minutes), Mean $\pm$ SD	78.4 $\pm$ 12.6	69.2 $\pm$ 11.8	0.002
Graft diameter (mm), Mean $\pm$ SD	8.6 $\pm$ 0.7	8.2 $\pm$ 0.6	0.012
Graft length (cm), Mean $\pm$ SD	6.8 $\pm$ 0.6	8.4 $\pm$ 0.8	<0.001
Estimated blood loss (mL), Mean $\pm$ SD	42.6 $\pm$ 12.4	55.8 $\pm$ 15.2	<0.001
Associated meniscal injury, n (%)	12 (34.3)	13 (37.1)	0.804
Intraoperative complications, n (%)	1 (2.9)	2 (5.7)	1.000
Hospital stay (days), Mean $\pm$ SD	2.1 $\pm$ 0.6	2.5 $\pm$ 0.8	0.021



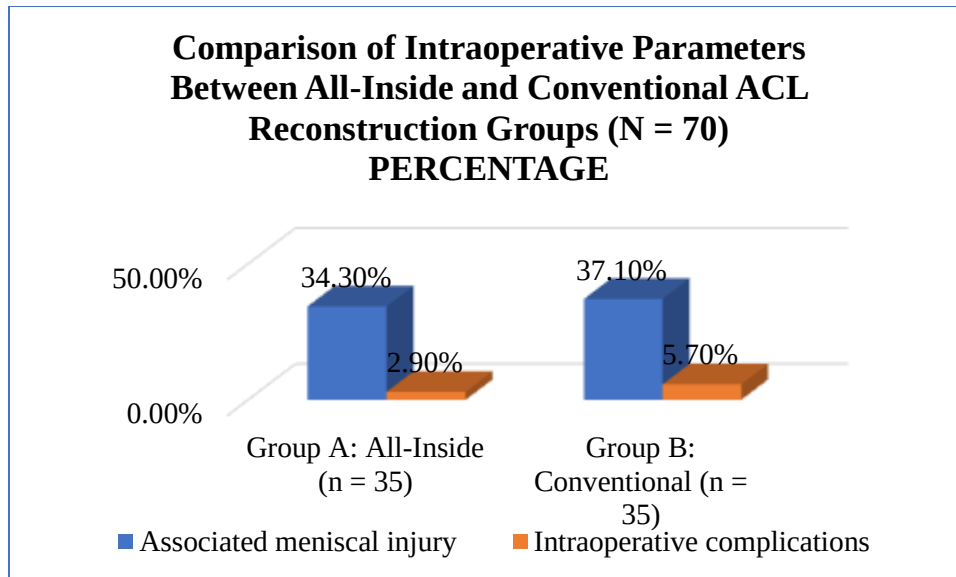


Figure 1 Comparison of Intraoperative Parameters Between All-Inside and Conventional ACL Reconstruction Groups (N = 70)

The comparison of intraoperative parameters is presented in Table 2 and Figure 1. The mean operative duration was significantly longer in Group A than Group B (78.4 ± 12.6 versus 69.2 ± 11.8 minutes; $p=0.002$). Group A demonstrated a significantly greater mean graft diameter (8.6 ± 0.7 versus 8.2 ± 0.6 mm; $p=0.012$), whereas graft length was significantly shorter (6.8 ± 0.6 versus 8.4 ± 0.8 cm; $p=0.05$). Furthermore, the mean duration of hospital stay was significantly shorter in Group A than Group B (2.1 ± 0.6 versus 2.5 ± 0.8 days; $p=0.021$).

Table 3. Comparison of Postoperative Pain (VAS Score) and Knee Range of Motion Between the Two Groups (N = 70)

Parameter	Group A: All-Inside (n = 35)	Group B: Conventional (n = 35)	p-value
VAS pain score, Mean $\pm$ SD			
Preoperative	5.8 ± 1.2	5.9 ± 1.3	0.739
Postoperative day 1	4.2 ± 1.1	5.1 ± 1.2	0.002
2 weeks	2.8 ± 0.9	3.5 ± 1.0	0.003
6 weeks	1.8 ± 0.8	2.3 ± 0.9	0.017
3 months	1.1 ± 0.6	1.3 ± 0.7	0.204
6 months	0.5 ± 0.5	0.6 ± 0.6	0.451
Knee flexion (degrees), Mean $\pm$ SD			
2 weeks	88.6 ± 10.4	82.4 ± 11.2	0.019
6 weeks	116.8 ± 9.2	110.2 ± 10.1	0.006
3 months	128.4 ± 7.6	125.6 ± 8.1	0.140
6 months	135.2 ± 5.8	133.8 ± 6.4	0.341

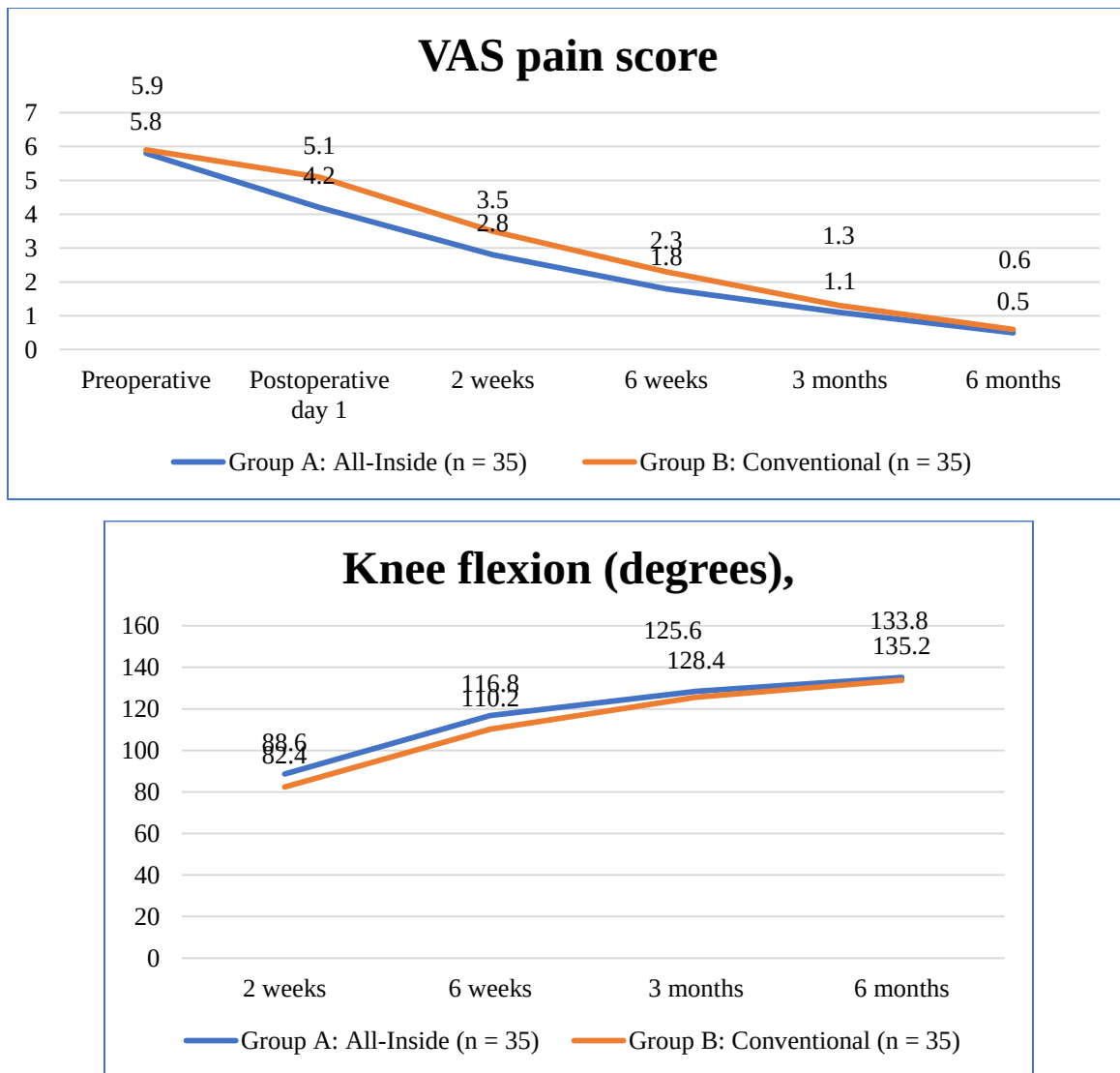


Figure 2 Comparison of Postoperative Pain (VAS Score) and Knee Range of Motion Between the Two Groups (N = 70)

As illustrated in Table 3 and Figure 2, postoperative pain progressively decreased in both groups during follow-up. Group A demonstrated significantly lower mean VAS scores on postoperative day 1 (4.2 ± 1.1 versus 5.1 ± 1.2 ; $p=0.002$), at 2 weeks (2.8 ± 0.9 versus 3.5 ± 1.0 ; $p=0.003$), and at 6 weeks (1.8 ± 0.8 versus 2.3 ± 0.9 ; $p=0.017$). However, differences in VAS scores at 3 and 6 months were not statistically significant ($p>0.05$). Knee flexion was significantly greater in Group A at 2 weeks ($88.6 \pm 10.4^\circ$ versus $82.4 \pm 11.2^\circ$; $p=0.019$) and 6 weeks ($116.8 \pm 9.2^\circ$ versus $110.2 \pm 10.1^\circ$; $p=0.006$). At 3 and 6 months, knee flexion remained numerically higher in Group A, although the differences were not statistically significant. These findings indicated better early postoperative pain control and knee mobility in the all-inside group.

Table 4. Comparison of Functional Outcomes Using Lysholm and IKDC Scores at Different Follow-Up Intervals (N = 70)

Functional parameter	Group A: All-Inside (n = 35)	Group B: Conventional (n = 35)	p-value
Lysholm Knee Score, Mean $\pm$ SD			
Preoperative	52.4 $\pm$ 8.6	51.8 $\pm$ 9.1	0.778
6 weeks	68.6 $\pm$ 8.2	64.2 $\pm$ 8.7	0.033
3 months	81.4 $\pm$ 7.6	77.2 $\pm$ 8.1	0.028
6 months	91.2 $\pm$ 5.8	88.4 $\pm$ 6.5	0.061
Improvement from baseline to 6 months	38.8 $\pm$ 9.4	36.6 $\pm$ 10.1	0.349
IKDC Subjective Knee Score, Mean $\pm$ SD			
Preoperative	48.6 $\pm$ 7.9	47.9 $\pm$ 8.2	0.717

6 weeks	65.4 ± 8.1	61.8 ± 8.6	0.076
3 months	78.6 ± 7.4	74.8 ± 7.9	0.041
6 months	88.6 ± 6.2	85.8 ± 6.8	0.077
Improvement from baseline to 6 months	40.0 ± 8.7	37.9 ± 9.2	0.330

The functional outcomes assessed using Lysholm and IKDC scores are summarized in Table 4. Both groups demonstrated progressive improvement in functional scores during the six-month follow-up period. The mean Lysholm score was significantly higher in Group A at 6 weeks (68.6 ± 8.2 versus 64.2 ± 8.7; $p=0.033$) and 3 months (81.4 ± 7.6 versus 77.2 ± 8.1; $p=0.028$). At 6 months, the mean Lysholm score was 91.2 ± 5.8 in Group A and 88.4 ± 6.5 in Group B, although the difference was not statistically significant ($p=0.061$). Similarly, the mean IKDC score was significantly higher in Group A at 3 months (78.6 ± 7.4 versus 74.8 ± 7.9; $p=0.041$). At 6 months, IKDC scores were 88.6 ± 6.2 and 85.8 ± 6.8, respectively ($p=0.077$). Improvements from baseline to 6 months in both Lysholm and IKDC scores were comparable between the groups ($p>0.05$), indicating that both techniques achieved substantial functional improvement.

Table 5. Comparison of Clinical Knee Stability and Functional Outcome Categories at 6 Months (N = 70)

Parameter	Group A: All-Inside (n = 35), n (%)	Group B: Conventional (n = 35), n (%)	p-value
Lachman test			0.710
Negative	32 (91.4)	30 (85.7)	
Grade I positive	3 (8.6)	5 (14.3)	
Anterior drawer test			0.673
Negative	33 (94.3)	31 (88.6)	
Grade I positive	2 (5.7)	4 (11.4)	
Pivot-shift test			1.000
Negative	33 (94.3)	32 (91.4)	
Positive	2 (5.7)	3 (8.6)	
Lysholm functional outcome			0.637
Excellent (95–100)	12 (34.3)	9 (25.7)	
Good (84–94)	19 (54.3)	19 (54.3)	
Fair (65–83)	4 (11.4)	7 (20.0)	
Poor (<65)	0 (0.0)	0 (0.0)	
Excellent/Good combined	31 (88.6)	28 (80.0)	0.324

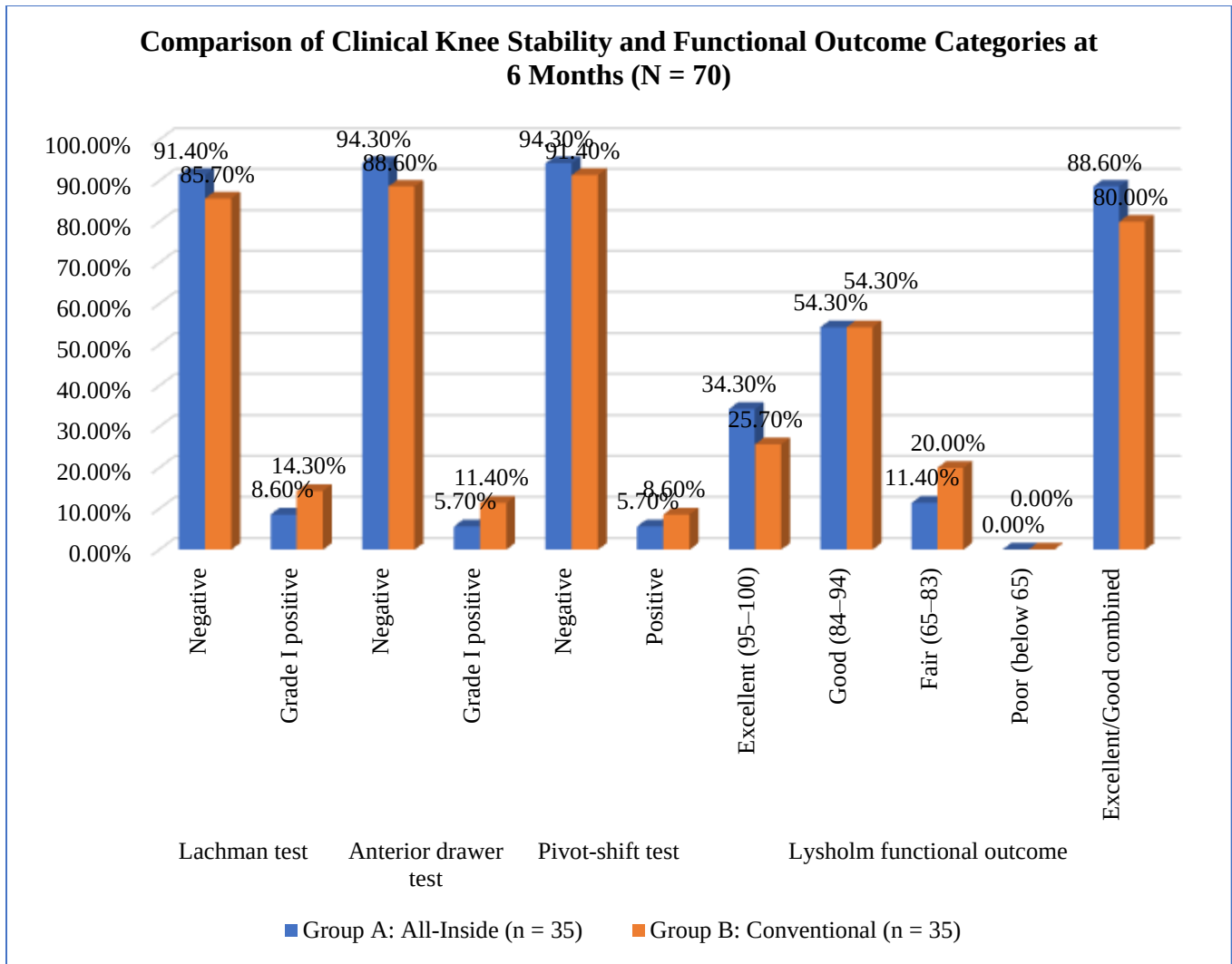


Figure 3 Comparison of Clinical Knee Stability and Functional Outcome Categories at 6 Months (N = 70)

The comparison of clinical knee stability and functional outcome categories at six months is presented in Table 5 and Figure 3. A negative Lachman test was observed in 91.4% of patients in Group A and 85.7% in Group B ($p=0.710$). Similarly, negative anterior drawer test findings were observed in 94.3% and 88.6% of patients, respectively ($p=0.673$), while negative pivot-shift test findings were recorded in 94.3% and 91.4% of patients ($p=1.000$). Regarding Lysholm functional outcome categories, excellent outcomes were achieved in 34.3% of patients in Group A compared with 25.7% in Group B. Good outcomes were observed in 54.3% of patients in both groups. The combined proportion of patients achieving excellent or good functional outcomes was higher in Group A (88.6%) than Group B (80.0%), although this difference was not statistically significant ($p=0.324$). Overall, both techniques demonstrated satisfactory clinical knee stability and functional outcomes at six months.

Table 6. Comparison of Postoperative Complications and Recovery Outcomes Between the Two Groups (N = 70)

Parameter	Group A: All-Inside (n = 35)	Group B: Conventional (n = 35)	p-value
Postoperative complications, n (%)			
Surgical-site infection	1 (2.9)	2 (5.7)	1.000
Knee stiffness	1 (2.9)	3 (8.6)	0.614
Persistent knee pain	2 (5.7)	4 (11.4)	0.673
Residual instability	2 (5.7)	3 (8.6)	1.000
Graft failure	0 (0.0)	1 (2.9)	1.000
Any postoperative complication	5 (14.3)	9 (25.7)	0.232
Recovery parameters, Mean $\pm$ SD			
Time to full weight-bearing (weeks)	3.8 $\pm$ 1.1	4.2 $\pm$ 1.2	0.151

Time to return to routine activities (weeks)	9.4 ± 2.1	10.8 ± 2.5	0.014
Time to achieve 120° knee flexion (weeks)	7.2 ± 1.8	8.4 ± 2.1	0.012
Patient satisfaction score (0–10)	8.9 ± 1.0	8.5 ± 1.2	0.135

As demonstrated in Table 6, postoperative complications were relatively infrequent in both groups. Surgical-site infection occurred in 2.9% of patients in Group A and 5.7% in Group B, while knee stiffness was reported in 2.9% and 8.6%, respectively. Persistent knee pain was observed in 5.7% of patients in Group A compared with 11.4% in Group B. Residual instability was recorded in 5.7% and 8.6% of patients, respectively, while graft failure occurred in one patient (2.9%) in Group B. The overall incidence of postoperative complications was lower in Group A (14.3%) compared with Group B (25.7%), although the difference was not statistically significant ($p=0.232$).

Regarding recovery outcomes, the mean time to return to routine activities was significantly shorter in Group A (9.4 ± 2.1 weeks) than Group B (10.8 ± 2.5 weeks; $p=0.014$). Similarly, the time required to achieve 120° knee flexion was significantly shorter in Group A (7.2 ± 1.8 versus 8.4 ± 2.1 weeks; $p=0.012$). Time to full weight-bearing was comparable between the groups ($p=0.151$). Patient satisfaction scores were numerically higher in Group A (8.9 ± 1.0) than Group B (8.5 ± 1.2), although the difference was not statistically significant ($p=0.135$).

DISCUSSION

The present comparative study evaluated the functional and clinical outcomes of all-inside versus conventional arthroscopic anterior cruciate ligament (ACL) reconstruction in 70 patients, with 35 patients in each group. The findings suggested that both techniques achieved satisfactory functional recovery and knee stability, although the all-inside technique demonstrated certain advantages in early postoperative pain, range of motion, and rehabilitation.

In the present study, the mean age was 28.6 ± 6.4 years in the all-inside group and 29.2 ± 7.1 years in the conventional group ($p = 0.712$). Male patients predominated in both groups (77.1% and 74.3%, respectively). Sports-related injuries were the most common mechanism of injury, accounting for 62.9% and 60.0% of cases. Baseline Lysholm, IKDC, and VAS scores were comparable between groups, indicating similar preoperative functional impairment.

The mean operative duration was significantly longer in the all-inside group (78.4 ± 12.6 minutes) than in the conventional group (69.2 ± 11.8 minutes; $p = 0.002$). However, estimated blood loss was lower with all-inside reconstruction (42.6 ± 12.4 versus 55.8 ± 15.2 mL; $p<0.001$). The all-inside group also had a larger mean graft diameter (8.6 ± 0.7 versus 8.2 ± 0.6 mm; $p = 0.012$) and shorter hospital stay (2.1 ± 0.6 versus 2.5 ± 0.8 days; $p = 0.021$).

The all-inside group demonstrated significantly lower postoperative VAS scores on day 1 (4.2 ± 1.1 versus 5.1 ± 1.2 ; $p = 0.002$), at 2 weeks (2.8 ± 0.9 versus 3.5 ± 1.0 ; $p = 0.003$), and at 6 weeks (1.8 ± 0.8 versus 2.3 ± 0.9 ; $p = 0.017$). Similarly, knee flexion was significantly greater at 6 weeks ($116.8 \pm 9.2^\circ$ versus $110.2 \pm 10.1^\circ$; $p = 0.006$). However, these differences were no longer statistically significant at 6 months, suggesting that the principal benefits of all-inside reconstruction were concentrated in the early recovery period.

These findings were consistent with Lubowitz et al. (2013) [17], who conducted a randomized trial involving 150 patients and reported significantly lower VAS pain scores following all-inside reconstruction, without significant differences in IKDC scores or knee stability at 2 years. Similarly, Goyal et al. (2022) [16], in a comparative study of 80 patients, reported lower VAS scores at 2 weeks (5.75 ± 0.6 versus 6.50 ± 0.5 ; $p = 0.0007$) and 6 weeks (1.78 ± 1.0 versus 2.5 ± 0.8 ; $p = 0.002$) with all-inside reconstruction.

In the present study, the mean Lysholm score at 6 months was 91.2 ± 5.8 in the all-inside group compared with 88.4 ± 6.5 in the conventional group ($p = 0.061$). Similarly, IKDC scores were 88.6 ± 6.2 and 85.8 ± 6.8 , respectively ($p = 0.077$). Although both scores favoured all-inside reconstruction, the differences were statistically insignificant.

Lv et al. (2023) [18], in a meta-analysis involving 544 patients across eight randomized trials, reported modest improvements favouring all-inside reconstruction in IKDC scores (mean difference 2.22; $p = 0.03$) and Lysholm scores (mean difference 1.09; $p = 0.01$). Conversely, Zhu et al. (2024) [19], analyzing 1,597 patients from randomized and cohort studies, reported largely comparable functional outcomes between techniques.

At 6 months, a negative Lachman test was observed in 91.4% of all-inside patients compared with 85.7% of conventional patients. Excellent or good Lysholm outcomes were achieved in 88.6% and 80.0%, respectively. Overall postoperative complications occurred in 14.3% and 25.7% of patients, although the difference was statistically insignificant ($p = 0.232$).

These findings were consistent with Lubowitz et al. (2013) [17], who observed comparable objective knee stability between techniques. Similarly, Lv et al. (2023) [18] reported no significant difference in graft re-rupture rates (RR 1.97; 95% CI 0.50–7.74; $p = 0.33$).

Overall, the present comparison suggested that all-inside reconstruction may provide advantages in early postoperative recovery, while both techniques achieved comparable functional outcomes and knee stability at 6 months.

Strengths of the Study

- The study directly compares all-inside and conventional arthroscopic ACL reconstruction in 70 patients.
- Both groups were comparable in baseline demographic and clinical characteristics.
- Standardized functional assessment tools, including the Lysholm score, IKDC score, and VAS, were used.
- Multiple postoperative parameters, including pain, knee range of motion, clinical stability, complications, and recovery time, were evaluated.
- The six-month follow-up provides information on both early recovery and short-term functional outcomes.

Future Scope

Future studies involving larger, multicentre patient populations and randomized study designs are recommended to validate these findings. Longer follow-up is needed to assess graft survival, long-term knee stability, return to sports, and postoperative complications. Further research may also evaluate the cost-effectiveness of both techniques and their outcomes in different patient populations.

Limitations

The present study was limited by its relatively small sample size of 70 patients and single-centre design, which may restrict the generalizability of the findings. The follow-up duration of 6 months was insufficient to evaluate long-term functional outcomes, graft survival, and postoperative complications. The non-randomized allocation of patients may have introduced selection bias, while variations in surgical technique and rehabilitation compliance could have influenced the results. Furthermore, objective instrumented assessment of knee laxity and postoperative imaging-based evaluation of graft integrity were not performed.

CONCLUSION

The present study suggested that both all-inside and conventional arthroscopic ACL reconstruction provided satisfactory functional recovery and clinical knee stability. All-inside reconstruction demonstrated advantages in terms of reduced early postoperative pain, improved early knee range of motion, lower intraoperative blood loss, and faster functional recovery. However, functional outcomes assessed using Lysholm and IKDC scores were comparable between the two groups at 6 months. Although the all-inside technique required a longer operative duration, it showed

favourable early postoperative outcomes. Thus, both techniques appeared effective, with all-inside reconstruction offering potential advantages during early rehabilitation.

DECLARATIONS

Ethical Approval: Ethical approval was obtained from the Institutional Ethics Committee.

Informed Consent: Written informed consent was obtained from all participants.

Conflict of Interest: The authors declare no conflict of interest.

Funding: No external funding was received for this study.

Author Contributions: All authors contributed to the study and approved the final manuscript.

Data Availability: Data are available from the corresponding author upon reasonable request.

Use of Artificial Intelligence: No artificial intelligence tools were used in the preparation of this manuscript.

Acknowledgements: None.

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