International Journal of Research in Orthopaedics
Khajotia BL et al. Int J Res Orthop. 2026 Nov;12(6):1703-1707
https://www.ijoro.org

Original Research Article

DOI: https://dx.doi.org/10.18203/issn.2455-4510.IntJResOrthop20263282

Clinical and functional outcome of arthroscopic anterior cruciate ligament reconstruction using autologous graft with biodegradable interference screw and adjustable loop endobutton: a prospective study

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Received: 08 August 2026
Revised: 07 September 2026
Accepted: 09 September 2026

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ABSTRACT

Background: Anterior cruciate ligament (ACL) injury is a common cause of knee instability, functional impairment, and increased risk of secondary meniscal injury and early osteoarthritis. Arthroscopic ACL reconstruction is the gold standard treatment for symptomatic ACL tears. Secure graft fixation using an autologous hamstring graft, biodegradable interference screw, and adjustable-loop Endobutton provides stable fixation, promotes graft incorporation, and facilitates early rehabilitation.
Methods: This prospective observational study included 60 patients with symptomatic ACL rupture treated at the Department of Orthopaedics, Sardar Patel Medical College and Associated Group of Hospitals, Bikaner. Preoperative assessment included clinical examination, MRI, Lysholm score, IKDC grading, and stability tests. All patients underwent arthroscopic ACL reconstruction using an autologous hamstring graft with femoral fixation by an adjustable-loop Endobutton and tibial fixation using a biodegradable interference screw. Functional outcomes and complications were evaluated during follow-up.
Results: The mean patient age was 28.9±6.3 years, and 81.7% were male. At final follow-up, 68.3% achieved an excellent Lysholm score, while 46.7% and 40.0% were graded as normal and nearly normal, respectively, on the IKDC scale. Most patients demonstrated restored knee stability with minimal complications. No implant failure, deep infection, or neurovascular injury was observed.
Conclusion: Arthroscopic ACL reconstruction using an autologous hamstring graft with biodegradable interference screw and adjustable-loop Endobutton provides excellent functional outcomes, reliable knee stability, and a low complication rate, making it a safe and effective treatment for symptomatic ACL injuries.

Keywords: Arthroscopic ACL reconstruction, Autologous hamstring graft, Biodegradable interference screw, Adjustable-loop endobutton, Lysholm knee score, IKDC score

INTRODUCTION

The anterior cruciate ligament (ACL) is the primary stabilizer of the knee joint, providing resistance to anterior tibial translation and rotational forces while maintaining normal knee biomechanics during functional activities. ACL injuries are among the most common ligamentous injuries encountered in orthopaedic practice and predominantly affect young, physically active individuals involved in sports and high-energy trauma. Persistent ACL deficiency leads to recurrent instability, meniscal injuries, articular cartilage degeneration, reduced functional

performance, and an increased risk of early osteoarthritis, significantly affecting the quality of life of affected individuals.[1-5]Arthroscopic anterior cruciate ligament reconstruction (ACLR) is the gold standard treatment for symptomatic complete ACL tears, with the objective of restoring knee stability, improving function, and enabling an early return to pre-injury activity levels. Successful ACL reconstruction depends on accurate tunnel placement, appropriate graft selection, secure fixation, biological graft incorporation, and a structured rehabilitation programme. Among these factors, graft fixation plays a vital role in maintaining stability during the early healing period.[6-8]

Autologous hamstring tendon grafts are widely preferred because of their excellent biomechanical properties, adequate graft strength, low donor-site morbidity, and favourable long-term clinical outcomes. Femoral fixation using an adjustable-loop Endobutton provides strong cortical suspension, allows optimal graft tensioning, and accommodates variable femoral tunnel lengths. Tibial fixation with biodegradable interference screws offers secure aperture fixation while eliminating permanent metallic implants, reducing magnetic resonance imaging (MRI) artefacts, and facilitating revision surgery when required. Recent studies have demonstrated satisfactory clinical outcomes with this fixation construct, although concerns regarding graft fixation, tunnel widening, and long-term functional outcomes continue to be investigated.[9-15] Despite advances in arthroscopic techniques and implant technology, evidence regarding the clinical and functional outcomes of ACL reconstruction using an autologous hamstring graft with biodegradable interference screw and adjustable-loop Endobutton fixation remains limited in the Indian population. Therefore, the present prospective study was undertaken to evaluate the clinical and functional outcomes of this technique using validated outcome measures, including the lysholm knee score and the international knee documentation committee (IKDC) score, to determine its effectiveness in restoring knee stability and function.

METHODS

This prospective hospital-based observational study was conducted in the Department of Orthopaedics, Sardar Patel Medical College and Associated Group of Hospitals, Bikaner, Rajasthan, over a period of one year after obtaining approval from the Institutional Ethics Committee. The study included patients presenting with symptomatic ACL rupture who underwent arthroscopic ACL reconstruction using an autologous hamstring tendon graft with femoral fixation by an adjustable-loop Endobutton and tibial fixation using a biodegradable interference screw.

Patients aged 18–50 years with clinically and radiologically confirmed ACL rupture and persistent instability despite adequate conservative treatment were included in the study. Patients with associated posterior cruciate ligament injury, multi ligament knee injury, advanced osteoarthritis, previous knee surgery, active infection, fractures around the knee, neuromuscular disorders, or significant lower limb deformity were excluded. A total of 60 consecutive patients fulfilling the inclusion criteria were enrolled after obtaining written informed consent. Preoperative evaluation included detailed history, clinical examination, Lachman test, anterior drawer test, pivot shift test, magnetic resonance imaging (MRI), and routine laboratory investigations. Functional assessment was performed using the Lysholm Knee Score and the International Knee Documentation Committee (IKDC) scoring system before surgery and at scheduled follow-up visits. All procedures were performed arthroscopically using a standardized surgical technique by experienced orthopaedic surgeons. Postoperative rehabilitation followed a uniform institutional protocol. Clinical and functional outcomes, knee stability, range of motion, and postoperative complications were recorded and analysed. Statistical analysis was performed using appropriate descriptive and inferential statistics, with a p value <0.05 considered statistically significant.

RESULTS

A total of 60 patients with symptomatic ACL rupture underwent arthroscopic ACL reconstruction using an autologous hamstring graft with femoral fixation by an adjustable-loop Endobutton and tibial fixation using a biodegradable interference screw. All patients completed the scheduled follow-up and were included in the final analysis.

Demographic profile

The mean age of the patients was 28.9±6.3 years (range: 18–48 years). The majority (48.3%) belonged to the 25–35 years age group, followed by 36.7% below 25 years and 15.0% above 35 years. Male patients constituted 81.7% (49 patients), while females accounted for 18.3% (11 patients). Urban residents represented 63.3% (38 patients) and rural residents 36.7% (22 patients).

Mode of injury

Sports-related injuries were the most common mechanism of injury, accounting for 58.3% (35 patients), followed by road traffic accidents in 33.3% (20 patients) and falls from height or domestic injuries in 8.4% (5 patients).

Involved knee

The right knee was involved in 56.7% (34 patients), while the left knee was affected in 43.3% (26 patients).

Primary treatment before surgery

Before surgery, 61.7% (37 patients) received conservative treatment consisting of analgesics, knee bracing, physiotherapy, and activity modification. The remaining

38.3% (23 patients) underwent early surgical intervention because of persistent instability and functional limitation.

Pre-operative clinical assessment

Preoperative assessment revealed that 70.0% (42 patients) had knee flexion between 100° and 120°, 16.7% (10 patients) had flexion less than 100°, and 13.3% (8 patients) had flexion greater than 120°. The Lachman test was Grade III in 83.3% (50 patients) and Grade II in 16.7% (10 patients). The Anterior Drawer test demonstrated Grade III laxity in 81.7% (49 patients) and Grade II laxity in 18.3% (11 patients). The Pivot Shift test was positive in 91.7% (55 patients). The mean preoperative Lysholm score was 54.8±8.5, while the mean IKDC subjective score was 48.6±9.3, indicating significant functional impairment.

Post-operative clinical outcomes

Range of motion

At final follow-up, 71.7% (43 patients) achieved knee flexion between 120° and 135°, 25.0% (15 patients) regained full flexion beyond 135°, and only 3.3% (2 patients) had flexion less than 120°. Full knee extension was achieved in 96.7% of patients.

Lachman test

At the final follow-up, 86.7% (52 patients) demonstrated a negative Lachman test, 10.0% (6 patients) had Grade I laxity, and 3.3% (2 patients) had Grade II laxity. No patient had Grade III laxity.

Anterior drawer test

The Anterior Drawer test was negative in 88.3% (53 patients). Mild residual laxity (Grade I) was observed in 8.3% (5 patients), while 3.4% (2 patients) had Grade II laxity.

Lysholm knee score

At the final follow-up, 68.3% (41 patients) achieved an excellent outcome (91–100), 21.7% (13 patients) had a good outcome (84–90), 8.3% (5 patients) had a fair outcome (65–83), and 1.7% (1 patient) had an unsatisfactory result.

IKDC grading

According to the IKDC grading system, 46.7% (28 patients) were graded normal (Grade A), 40.0% (24 patients) were nearly normal (Grade B), 10.0% (6 patients) were abnormal (grade C), and 3.3% (2 patients) were severely abnormal (Grade D).

Complications

Postoperative complications were minimal. Mild knee effusion occurred in 10.0% (6 patients), transient knee stiffness in 11.7% (7 patients), superficial wound infection in 3.3% (2 patients), and graft-site pain in 5.0% (3 patients). No patient developed deep infection, implant failure, screw breakage, neurovascular injury, or required revision surgery during the follow-up period.

Summary of outcomes

Arthroscopic ACL reconstruction using an autologous hamstring graft with biodegradable interference screw and adjustable-loop Endobutton fixation resulted in excellent clinical and functional outcomes. Significant improvement in knee stability, range of motion, and IKDC scores was achieved, with minimal postoperative complications, demonstrating the procedure to be safe, reliable, and effective.

Table 1: Demographic and baseline characteristics of patients (n=60).

Parameters	Observation
Mean age (in years)	28.9±6.3 (Range: 18–48 years)
Age distribution	<25 years: 22 (36.7%); 25–35 years: 29 (48.3%); >35 years: 9 (15.0%)
Gender	Male: 49 (81.7%); Female: 11 (18.3%)
Residence	Urban: 38 (63.3%); Rural: 22 (36.7%)
Mode of injury	Sports injury: 35 (58.3%); Road traffic accident: 20 (33.3%); Fall/Domestic injury: 5 (8.4%)
Involved knee	Right: 34 (56.7%); Left: 26 (43.3%)
Primary treatment before surgery	Conservative treatment: 37 (61.7%); Early surgery: 23 (38.3%)

Table 2: Clinical assessment before and after arthroscopic ACL reconstruction (n=60).

Parameters	Pre-operative (%)	Post-operative (%)
ROM <100°	10 (16.7)	2 (3.3)
ROM 100°–120°	42 (70.0)	–
ROM 120°–135°	–	43 (71.7)
ROM >120°/>135°	8 (13.3)	15 (25.0)

Continued.

Parameters	Pre-operative (%)	Post-operative (%)
Full knee extension	–	58 (96.7)
Lachman Grade III	50 (83.3)	0
Lachman Grade II	10 (16.7)	2 (3.3)
Lachman Grade I	0	6 (10.0)
Negative Lachman Test	0	52 (86.7)
Anterior Drawer Grade III	49 (81.7)	0
Anterior Drawer Grade II	11 (18.3)	2 (3.4)
Anterior Drawer Grade I	0	5 (8.3)
Negative anterior drawer test	0	53 (88.3)
Positive pivot shift test	55 (91.7)	Significant improvement

Table 3: Functional outcome following arthroscopic ACL reconstruction (n=60).

Parameters	Observation
Mean pre-operative lysholm score	54.8±8.5
Mean pre-operative IKDC score	48.6±9.3
Lysholm score	Excellent: 41 (68.3%); good: 13 (21.7%); fair: 5 (8.3%); unsatisfactory: 1 (1.7%)
IKDC grade	Grade A (normal): 28 (46.7%); Grade B (nearly normal): 24 (40.0%); Grade C (abnormal): 6 (10.0%); Grade D (severely Abnormal): 2 (3.3%)

Table 4: Post-operative complications (n=60).

Complications	Patients (%)
Knee effusion	6 (10.0)
Knee stiffness	7 (11.7)
Superficial wound infection	2 (3.3)

DISCUSSION

The present prospective study of 60 patients evaluated arthroscopic ACL reconstruction using an autologous hamstring graft with adjustable-loop Endobutton femoral fixation and biodegradable interference screw tibial fixation. The mean age was 28.9±6.3 years, 85% were below 35 years, and 81.7% were male. Sports injuries (58.3%) were the predominant mechanism, followed by road traffic accidents (33.3%). This demographic and injury pattern is consistent with previous epidemiological studies reporting ACL injury predominantly among young and physically active individuals.[1-3,13] Preoperatively, 83.3% had Grade III Lachman, 81.7% Grade III Anterior Drawer, and 91.7% a positive pivot shift, with mean Lysholm and IKDC subjective scores of 54.8±8.5 and 48.6±9.3, respectively. These findings indicate substantial instability and functional impairment. Following reconstruction, 86.7% achieved a negative Lachman and 88.3% a negative Anterior Drawer, with no Grade III residual laxity. These results are comparable with previous studies of adjustable-loop fixation, which have demonstrated satisfactory postoperative stability.[4,10,11] One study reported 84.4% negative Lachman tests and a mean Lysholm score of 96.91 at two years.[10] Range of motion was satisfactorily restored, with 96.7% achieving ≥120° flexion and 96.7% full extension. These findings are consistent with studies reporting satisfactory motion after hamstring ACL reconstruction.[14] Functional outcomes were favourable: 90% achieved excellent/good Lysholm results and 86.7% were IKDC normal/nearly normal. These outcomes are consistent with evidence showing comparable functional results with bioabsorbable and metallic interference screws.[7] Xu et al found no significant difference in Lysholm, IKDC, ROM, Lachman, or pivot-shift outcomes between screw types.[7] Complications were limited to effusion (10%), stiffness (11.7%), superficial infection (3.3%), and graft-site pain (5%); no implant failure, deep infection, neurovascular injury, or revision occurred.

Limitations

The study was limited by its small sample size, absence of a control group, limited follow-up, and lack of instrumented laxity and radiological tunnel-widening assessment. Return-to-sport outcomes were also not assessed in detail.

CONCLUSION

The present prospective study demonstrated that arthroscopic ACL reconstruction using an autologous hamstring graft with biodegradable interference screw fixation on the tibial side and an adjustable-loop Endobutton on the femoral side is a safe and effective

surgical technique. Patients showed significant improvement in knee stability, range of motion, and functional outcomes, as evidenced by improved lysholm knee scores and IKDC grading at final follow-up. The majority of patients achieved excellent to good functional recovery with a low incidence of postoperative complications. Complications such as knee effusion, stiffness, superficial wound infection, and graft-site pain were infrequent and managed successfully with conservative treatment. Overall, this fixation construct provides reliable graft stability, facilitates early rehabilitation, and represents an effective option for restoring knee function following ACL reconstruction.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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Cite this article as: Khajotia BL, Choudhary M, Singh P, Meena R. Clinical and functional outcome of arthroscopic anterior cruciate ligament reconstruction using autologous graft with biodegradable interference screw and adjustable loop endobutton: a prospective study. Int J Res Orthop 2026;12:1703-7.