



PROSPECTIVE EVALUATION OF FUNCTIONAL OUTCOMES AFTER ARTHROSCOPIC ACL RECONSTRUCTION USING HAMSTRING TENDON AUTOGRAFT IN CHRONIC ACL INJURIES

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ABSTRACT

Background: An injury to the anterior cruciate ligament is a prevalent source of knee instability in young, active persons. Chronic ACL deficit can result in recurrent instability, diminished functional capability, and concomitant meniscal or chondral injuries. Arthroscopic ACL restoration reconstruction with hamstring tendon autograft is highly endorsed due to its superior graft strength, reduced donor-site morbidity, and acceptable functional recovery. **Aim:** To evaluate the functional outcome of arthroscopic anterior cruciate ligament reconstruction using hamstring tendon autograft in patients with chronic ACL injury. **Materials and Methods:** This prospective observational research involved 50 patients with persistent ACL injuries who received arthroscopic ACL reconstruction restoration utilising hamstring tendon autografts. Patients were evaluated preoperatively and postoperatively for knee stability, functional outcomes, intraoperative observations, and complications. Clinical stability was examined by the Lachman test, whereas functional outcomes were evaluated using IKDC grading at the final follow-up. **Results:** The majority of patients were in the 26–35-year age bracket, exhibiting a male preponderance. Road traffic accidents were the most prevalent cause of injury. In all, 76% of patients had surgery more than six months post-injury. Meniscal injuries were identified in 30% of patients. Preoperatively, all patients had a positive Lachman test; postoperatively, 84% demonstrated a negative Lachman test, while 16% presented with grade 1+ laxity. At the final follow-up, 84% of patients had normal or substantially normal IKDC grades. Complications were negligible, and no graft failure was seen. **Conclusion:** Arthroscopic ACL reconstruction restoration with hamstring tendon autograft yielded favourable functional recovery, enhanced knee stability, and minimal complication rates in chronic ACL injuries. The surgery is both safe and efficient for restoring function in symptomatic knees deficient in the anterior cruciate ligament (ACL).

KEYWORDS :

INTRODUCTION

The anterior cruciate ligament damage is a prevalent ligamentous lesion of the knee, especially among young and physically active adults. It typically arises from sports-related torsional injuries, abrupt deceleration, pivoting actions, or vehicular accidents. Untreated ACL deficit can result in recurrent instability, bouts of giving way, diminished functional performance, meniscal injury, chondral damage, and premature degenerative changes. Consequently, the primary objective in the treatment of symptomatic ACL injuries is the restoration of knee stability and functional capability.^[1,2]

Arthroscopic anterior cruciate ligament replacement has emerged as the recommended surgical intervention for patients with functionally unstable knees, particularly among young and active adults. The hamstring tendon autograft is a prevalent choice among graft choices due to its sufficient strength, little smaller incision, less anterior knee discomfort, lower donor-site morbidity, and favourable functional recovery. The measurement of functional outcomes using proven scoring systems, including the Lysholm knee score, International Knee Documentation Committee score, Tegner

activity scale, and clinical stability tests, enables an objective evaluation of postoperative recovery and reintegration into everyday activities.^{–[35]}

The necessity for this study stems from the prevalence of patients with chronic ACL injuries as opposed to acute tears, especially in contexts where delayed consultation, initial conservative management, or financial and occupational limitations defer deferring surgical surgery treatment. Chronic ACL-deficient knees may have concomitant meniscal or cartilage alterations that might affect surgical functional results. Therefore, a prospective assessment of functional outcomes after arthroscopic ACL reconstruction utilising hamstring tendon autograft in a primarily chronic ACL injury population is essential to evaluate the efficacy of this procedure, record functional enhancement, and inform future patients counselling about anticipated recovery post-surgery.

Objectives

Primary Objective:

To evaluate the functional outcome of arthroscopic anterior cruciate ligament reconstruction using hamstring tendon autograft in patients with chronic ACL injury.

Secondary Objectives:

To assess postoperative improvement in knee stability using clinical tests such as Lachman test, anterior drawer test, and pivot shift test.

To compare preoperative and postoperative functional status using validated knee scoring systems such as the Lysholm Knee Score and/or International Knee Documentation Committee score.

To assess postoperative pain relief, range of motion, and return to routine daily activities following arthroscopic ACL reconstruction.

To document associated intra-articular findings such as meniscal and chondral injuries observed during arthroscopy. To identify early postoperative complications such as infection, stiffness, residual instability, graft failure, and donor-site morbidity.

MATERIALS AND METHODS

This prospective observational study was carried out in the Department of Orthopaedics at Vydehi Institute of Medical Science and Research Centre. The study comprised 50 patients with clinically and radiologically confirmed chronic anterior cruciate ligament injuries who underwent arthroscopic ACL reconstruction restoration with hamstring tendon autografts. Patients exhibiting symptomatic knee instability, positive clinical assessments, and MRI-verified ACL tears were included following the acquisition of written informed consent. Patients were excluded if they had undergone revision ACL reconstruction, sustained multi-ligament injuries, had prior surgery on the afflicted knee, exhibited advanced osteoarthritis, experienced periarticular fractures, suffered from inflammatory arthritis, possessed neuromuscular abnormalities, or were reluctant to participate in follow-up.

All patients had a comprehensive preoperative evaluation encompassing medical history, mechanism of injury, symptom duration, affected side, reports of instability, discomfort, oedema, joint locking, and restrictions in daily or athletic activity. The clinical examination encompassed the evaluation of range of motion and knee stability by the Lachman test, anterior drawer test, and pivot shift test. Standard radiographs were acquired to exclude osseous disease, while MRI was employed to verify ACL rupture and detect concomitant meniscal or chondral damage. The preoperative functional state was evaluated with the Lysholm Knee Score and/or the International Knee Documentation Committee score.

Arthroscopic anterior cruciate ligament reconstruction restoration was conducted with a hamstring tendon autograft (semitendinosus and/or gracilis tendons) obtained from the semitendinosus and/or gracilis tendons from the ipsilateral lower limb. Diagnostic arthroscopy was performed to evaluate the ACL injury and related intra-articular abnormalities. The graft was prepared, femoral and tibial tunnels were established using normal arthroscopic techniques, and graft fixation was performed with suitable fixation devices. Associated meniscal or chondral lesions were addressed as necessary. Postoperatively, all patients adhered to a systematic rehabilitation plan encompassing early quadriceps activation, progressive knee range of motion exercises, weight-bearing advancement, strengthening exercises, and a gradual resumption of usual activities.

Patients were monitored at regular intervals, ideally at 6 weeks, 3 months, and 6 months post-surgery. During each visit, pain, oedema, range of motion, knee stability, complications, and functional recovery were evaluated. The main goal was enhancement in functional score post-surgery,

whereas secondary outcomes encompassed improvement in knee stability, range of motion, resumption of daily activities, and postoperative complications. Data were inputted into Microsoft Excel and analysed via suitable statistical tools. Continuous values were presented as mean and standard deviation, whilst categorical variables were represented as frequency and percentage. Preoperative and postoperative ratings were analysed using either the paired t-test or the Wilcoxon signed-rank test, with a p-value of <0.05 being statistically significant.

RESULTS

Table 1: Distribution of Study Subjects Based on Age and Sex

Age Group	Male	Female	Total	Percentage
18–25 years	14	2	16	32.0
26–35 years	19	3	22	44.0
36–45 years	8	1	9	18.0
46–55 years	2	1	3	6.0
Total	43	7	50	100.0

Inference: The majority of patients were in the 26–35-year age bracket, comprising 44.0% of the study population. A pronounced male preponderance was seen, with men constituting 86.0% of cases, indicating that ACL injuries were more prevalent among young, active guys.

Table 2: Distribution Based on Mode of Injury and Side Involved

Variable	Number of Patients	Percentage
Mode of Injury		
Road traffic accident	28	56.0
Sports injury	17	34.0
Fall / twisting injury	5	10.0
Side Involved		
Right knee	31	62.0
Left knee	19	38.0

Inference: Road traffic accidents constituted the predominant cause of injury, occurring in 56.0% of patients, succeeded by sports injuries at 34.0%. The right knee was more often affected than the left knee, comprising 62.0% of cases.

Table 3: Distribution Based on Duration from Injury to Surgery

Duration from Injury to Surgery	Number of Patients	Percentage
3–6 months	12	24.0
7–12 months	24	48.0
13–18 months	9	18.0
> 18 months	5	10.0
Total	50	100.0

Inference: Approximately fifty percent of the patients required underwent a surgical intervention between 7 and 12 months post-injury, suggesting a considerable delay in presentation in several instances. In all, 76.0% of patients experienced a period delay beyond 6 months from injury to surgery, indicating the chronic nature of the ACL injury group.

Table 4: Associated Intraoperative Findings

Arthroscopic Finding	Number of Patients	Percentage
Isolated ACL tear	34	68.0
Medial meniscus tear	5	10.0
Lateral meniscus tear	8	16.0
Both medial and lateral meniscus tear	2	4.0
Minor chondral lesion	1	2.0
Total	50	100.0

Inference: Isolated anterior cruciate ligament tears were observed in 68.0% of patients. Meniscal injuries were

identified in 30.0% of patients, with lateral meniscus tears occurring more frequently than medial meniscus tears. This discovery indicates that persistent ACL insufficiency may correlate with subsequent intra-articular disease.

Table 5: Preoperative and Postoperative Lachman Test Findings

Lachman Grade	Preoperative	Percentage	Postoperative	Percentage
Negative	0	0.0	42	84.0
Grade 1+	0	0.0	8	16.0
Grade 2+	18	36.0	0	0.0
Grade 3+	32	64.0	0	0.0
Total	50	100.0	50	100.0

Inference: Prior to surgery, all patients had positive Lachman test results, with Grade 3+ laxity observed in 64.0% of instances. Postoperatively, 84.0% of patients exhibited a negative Lachman test, while the remaining 16.0% had only Grade 1+ laxity, signifying significant enhancement in anterior knee stability following ACL replacement.

Table 6: Functional Outcome Based on IKDC Grade at Final Follow-Up

IKDC Grade	Number of Patients	Percentage
Normal	25	50.0
Nearly normal	17	34.0
Abnormal	8	16.0
Severely abnormal	0	0.0
Total	50	100.0

Inference: At the final follow-up, 84.0% of patients exhibited normal or nearly normal IKDC grades, indicating favourable functional recovery following arthroscopic ACL reconstruction restoration with hamstring tendon autograft. Only 16.0% of patients had altered functional status, and none experienced extremely abnormal results.

Table 7: Postoperative Complications

Complication	Number of Patients	Percentage
No complication	43	86.0
Knee stiffness	2	4.0
Mild effusion	3	6.0
Hemarthrosis	1	2.0
Superficial infection	1	2.0
Graft failure	0	0.0
Total	50	100.0

Inference: The majority of patients experienced a smooth surgical recovery, with 86.0% exhibiting no problems. Mild effusion was the predominant complication, seen in 6.0% of patients. No instances of graft failure were seen, indicating favourable short-term graft stability and an acceptable surgical result.

DISCUSSION

Our study demonstrated that arthroscopic anterior cruciate ligament reconstruction utilising hamstring tendon autograft yielded good short-term functional and clinical results in individuals mostly with chronic ACL injuries. The majority of patients were young adults, predominantly in the 26–35-year age bracket, with a significant male predominance. This demographic trend parallels the findings of Shaikh et al., who also documented ACL injuries and reconstruction results mostly in young, active male patients having single-bundle anatomic ACL repair utilising hamstring autograft. The increased participation of young boys in our study may be ascribed to heightened exposure to road traffic accidents, occupational physical exertion, and sports-related pivoting activities.^[6]

In our study, road traffic accidents were the predominant

cause of injury, succeeded by sports injuries. This contrasts somewhat with several Western series, where non-contact pivoting trauma connected to sports frequently serves as the primary cause of ACL damage. In Indian and other tertiary-care environments, road traffic accidents significantly contribute to ligamentous knee injuries due to two-wheeler usage, delayed presentation, and high-energy torsional trauma. In our investigation, the right knee was more often affected, but lateral predominance has not consistently demonstrated a significant impact on the ultimate functional result.^[3,6]

A significant observation in our study was the chronicity of the group, with 76% of patients requiring surgery more than six months post-injury. Delayed presentation is clinically significant as chronic ACL-deficient knees have a heightened susceptibility to recurrent instability and subsequent meniscal or chondral injury. Biswal et al. assessed the influence of age, time elapsed since injury, and meniscal damage on short-term outcomes following ACL repair, concluding that these factors did not substantially impact short-term functional recovery. Our study shown that, despite delayed surgery in a significant number of patients, favourable postoperative functional recovery was achieved, indicating that arthroscopic ACL reconstruction restoration using hamstring autograft remains beneficial in chronic cases when accompanied by proper rehabilitation.^[7]

Intra-articular lesions were identified in 32% of our patients, with meniscal injuries constituting 30% of these cases. Lateral meniscus tears were more prevalent than medial meniscus tears in our study. This is clinically relevant as meniscal damage may affect postoperative pain, rehabilitation, and long-term joint preservation. Redler et al. indicated that concurrent meniscal injuries addressed during ACL repair did not markedly impair early strength, balance, or functional recovery at the six-month mark. The results of our study corroborate this observation, since the majority of patients attained normal or almost normal IKDC grades, despite the occurrence of concomitant meniscal injuries in around one-third of instances.^[8]

Postoperative knee stability was enhanced in our research. Prior to surgery, all patients exhibited a positive Lachman test, with 64% demonstrating grade 3+ laxity. At the final follow-up, 84% exhibited a negative Lachman test, while the remaining 16% had only grade 1+ laxity. This illustrates successful reconstruction restoration of anterior knee stability post-reconstruction. Khan et al. showed analogous enhancements in clinical stability, noting positive functional results following arthroscopic ACL reconstruction restoration using a quadrupled hamstring autograft. Çokyazar et al. also documented a substantial enhancement in functional knee scores, including Lysholm, IKDC, and Tegner, following ACL repair, corroborating the functional advantages shown in our study.^[3,9]

The functional outcomes in our trial were promising, with 84% of patients attaining normal or very normal IKDC grades at the end follow-up, and none exhibiting substantially aberrant outcomes. These findings align with those documented in prospective trials of hamstring autograft ACL reconstruction restoration, wherein the majority of patients attained favourable to exceptional subjective and objective knee ratings post-surgery. Shaikh et al. reported favourable clinical and functional results after single-bundle anatomic ACL reconstruction restoration with hamstring autograft. The favourable results in our study can be ascribed to arthroscopic anatomic reconstruction, secure graft attachmentfixation, management of concomitant intra-articular pathology, and a systematic postoperative rehabilitation protocol.

Postoperative complications were negligible in our study. The majority of patients experienced a smooth recovery, with minor effusion in 6%, stiffness in 4%, hemarthrosis in 2%, and superficial infection in 2%. No instances of graft failure were observed during the follow-up period. The minimal complication rate corroborates the safety of hamstring tendon autograft repair/reconstruction. Hardy et al. observed in their analysis of graft-harvest consequences that hamstring graft harvest typically results in less anterior knee discomfort compared to bone-patellar tendon-bone grafts, but sensory disturbances linked with the infrapatellar branch of the saphenous nerve may arise. Our investigation revealed no significant donor-site morbidity or graft failure, indicating acceptable short-term safety.^[10]

Our study demonstrates that arthroscopic ACL repair with hamstring tendon autograft yields favourable functional recovery, dependable restoration of knee stability, and minimal complication rates in chronic ACL injuries. The results align with previous research conducted by Shaikh et al., Khan et al., Biswal et al., Redler et al., and Çokyavaş et al. Despite the prevalence of chronicity and concomitant meniscal injuries in our population, these factors did not hinder excellent short-term results. Nevertheless, extended follow-up is essential to evaluate sports resumption, graft longevity, recurrent instability, and the onset of post-traumatic osteoarthritis.

The primary feature of our study was its prospective design and concentrated assessment of functional outcomes after arthroscopic ACL reconstruction restoration with hamstring tendon autograft in a group with chronic ACL injuries. The implementation of objective clinical stability assessments, such as the Lachman test, in conjunction with functional evaluation by IKDC grading, facilitated a systematic appraisal of postoperative recovery. The research additionally recorded related intra-articular findings and early complications, providing a thorough short-term assessment of surgery outcomes.

The primary limitation of our study was the limited sample size of 50 patients and the brief follow-up period, which may be inadequate for evaluating long-term graft survival, resumption of sports, recurrent instability, or the onset of osteoarthritis. The research was performed at a single location, perhaps restricting its generalisability. Moreover, a comprehensive comparison of preoperative and postoperative numerical functional ratings, such as Lysholm or IKDC subjective scores, was lacking, and the absence of a control or comparative graft group limited direct comparison with alternative reconstruction methods.

Our study demonstrated that arthroscopic ACL reconstruction restoration with hamstring tendon autograft resulted in favourable functional recovery, significant enhancement in anterior knee stability, and a minimal complication rate in patients with chronic ACL injuries. Notwithstanding postponed surgery and concomitant meniscal injuries in certain individuals, the majority attained normal or relatively normal IKDC results. These findings endorse hamstring tendon autograft ACL repair as an efficacious and safe method for re-establishing knee stability and functional capability in chronic ACL-deficient knees.

CONCLUSION

Our research shown showed that arthroscopic anterior cruciate ligament restoration reconstruction utilising hamstring tendon autograft yielded good functional results in individuals with chronic ACL injuries. The majority of patients attained normal or almost normal IKDC grades at the final follow-up, demonstrating significant enhancement in anterior knee stability as indicated by postoperative Lachman test

results. The findings demonstrate that hamstring tendon autograft is a viable graft choice for reinstating knee stability and enhancing functional capability in chronic ACL-deficient knees.

Notwithstanding the delayed presentation and concomitant meniscal injuries in certain patients, the overall surgical recovery was favourable, characterised by a low complication rate and the absence of graft failure during the follow-up period. The findings endorse arthroscopic ACL reconstruction restoration utilising hamstring tendon autograft as a secure and dependable technique for symptomatic chronic ACL injury. Extended follow-up studies with bigger cohorts are advised to evaluate long-term graft viability, resumption of athletic activities, and the prevention of degenerative knee alterations.

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