

Original Research Article

COMPARISON OF SHORT-TERM CLINICAL OUTCOMES OF FIXED LOOP VERSUS ADJUSTABLE LOOP AS FEMORAL CORTICAL SUSPENSION DEVICES IN ARTHROSCOPIC ANTERIOR CRUCIATE LIGAMENT RECONSTRUCTION

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ABSTRACT

Background: Various methods of femoral graft fixation are available, among which cortical loop fixation devices are most commonly used. This study aims to compare fixed loop and adjustable loop devices in terms of clinical outcomes.

Materials and Methods: In this prospective randomized study, patients were divided into two groups based on the type of femoral fixation device used. Clinical outcomes were assessed at 6 months and 1 year using the International Knee Documentation Committee (IKDC) and Lysholm scores.

Results: Both groups were comparable in terms of demographic characteristics and preoperative scores. Postoperatively, no statistically significant difference was observed between the two groups at 6 months or at 1 year.

Conclusion: Arthroscopic ACL reconstruction yields comparable short-term clinical outcomes when either fixed loop or adjustable loop devices are used for femoral cortical fixation.

Keywords: Fixed loop device, Adjustable loop device, Arthroscopic anterior cruciate ligament reconstruction.

INTRODUCTION

Stable graft fixation is a fundamental requirement in arthroscopic anterior cruciate ligament (ACL) reconstruction, as it plays a critical role in achieving optimal functional outcomes, particularly during the early phases of graft healing and ligamentization.^[1] A wide range of graft fixation techniques are available for both the tibial and femoral sides, reflecting continuous advancements in surgical methods and implant technologies.^[2]

Among these, cortical suspensory fixation devices have emerged as the preferred standard for femoral fixation of soft tissue grafts and are extensively utilized in current clinical practice.^[3] Fixed loop devices are among the most commonly employed options; however, their use necessitates overdrilling of the femoral tunnel to permit flipping of the cortical button beyond the cortex. This may result in micromotion of the graft within the tunnel and a reduction in the effective bone-graft contact area.^[3]

With the growing emphasis on anatomic tunnel placement—which frequently results in shorter femoral tunnel lengths—there is an increasing need to preserve bone stock while maximizing the graft-bone interface. Adjustable loop devices, considered second-generation suspensory fixation systems, address this limitation by eliminating the requirement for tunnel overdrilling, thereby potentially enabling improved graft positioning and biological integration.^[3,4]

Nevertheless, despite these theoretical advantages, several biomechanical studies have indicated that fixed loop devices may demonstrate superior performance in terms of resistance to cyclic loading and higher ultimate load to failure under in vitro conditions.^[5-7]

In this context, the present study aims to compare the short-term clinical outcomes of fixed loop and adjustable loop femoral suspensory fixation devices at a follow-up period of one year.

MATERIALS AND METHODS

A prospective randomized study was conducted at a tertiary care hospital between June 2018 and October 2020, involving patients undergoing arthroscopic anterior cruciate ligament (ACL) reconstruction.

Inclusion Criteria

Adult patients of either sex with clinically and radiologically confirmed ACL tears and a normal contralateral knee were included. Patients presenting with minor meniscal injuries amenable to partial meniscectomy were also considered eligible for inclusion.

Exclusion Criteria

Patients with a history of prior knee deformity or surgery, those undergoing revision ACL reconstruction, individuals with multiligament injuries, meniscal tears requiring repair, RAMP lesions, avulsion fractures, tibial plateau fractures, pediatric patients, those with associated knee osteoarthritis, and patients unwilling to participate in the study were excluded.

A total of 114 patients were enrolled and randomly allocated into two groups using an online random number generator:

- Group A (n = 56): Adjustable loop device
- Group B (n = 58): Fixed loop device

Ethical clearance was obtained from the institutional review board, and written informed consent was secured from all participants prior to enrollment.

All procedures were performed using ipsilateral hamstring tendon autografts. Femoral tunnel placement was achieved using a transportal anatomic technique, with drilling performed at 120° of knee flexion through an accessory anteromedial portal.

In the fixed loop group, femoral tunnels were overdrilled by 8–10 mm to facilitate flipping of the

cortical button. In contrast, overdrilling was not required in the adjustable loop group.

Tibial fixation was achieved using interference screws in all cases.

Postoperatively, all patients were immobilized with a knee brace and followed a standardized rehabilitation protocol. Functional outcomes were evaluated using the International Knee Documentation Committee (IKDC) and Lysholm scoring systems at 6 months and 1 year postoperatively. All assessments were conducted by an observer blinded to group allocation. Statistical analysis was performed using paired and unpaired t-tests for continuous variables, while Fisher's exact test was applied for categorical variables. A p-value of <0.05 was considered statistically significant.

RESULTS

Out of 114 patients, two were excluded due to deep infections requiring reoperation. Thus, 112 patients (54 in Group A and 58 in Group B) were analyzed.

Baseline demographic characteristics and preoperative scores were comparable between groups [Table 1].

Both IKDC and Lysholm scores showed significant improvement at 6 months compared to preoperative values in both groups. However:

- No significant difference was observed between 6-month and 1-year scores within each group.
- No statistically significant difference was found between the two groups at either follow-up interval [Table 2].

Six patients (2 in Group A and 4 in Group B) developed superficial infections at the graft harvest site, which resolved with oral antibiotics. No major complications were noted.

Table 1: Comparison of Demographic Parameters

Parameter	Group A	Group B	p-value
Age	30.31	31.37	>0.05 (0.344)
Sex (Male:Female)	40:14	43:15	>0.05 (1.000)
Associated Meniscal Lesion	10	16	>0.05 (0.3923)

Table 2: Comparison of Outcomes (IKDC and Lysholm Scores)

Score	Duration	Group A (n=54)	SD	Group B (n=58)	SD	p-value
IKDC	Pre-op	36.53	5.55	35.03	6.34	>0.05
	6 months	77.27	3.75	77.53	5.23	>0.05
	1 year	79.25	2.56	78.96	3.12	>0.05
Lysholm	Pre-op	51.29	6.52	50.86	8.84	>0.05
	6 months	84.91	3.22	85.34	2.71	>0.05
	1 year	86.48	2.58	86.37	2.93	>0.05

DISCUSSION

The primary objectives of arthroscopic anterior cruciate ligament (ACL) reconstruction are to facilitate early rehabilitation and enable patients to return to their pre-injury functional status. Achieving these outcomes is critically dependent on secure and stable graft fixation, particularly during the early postoperative period, to prevent micromotion

phenomena such as the “bungee effect,” which may contribute to tunnel widening and compromised graft incorporation.^[8,10]

Adjustable loop devices have gained increasing attention due to their technical advantages, including the elimination of the need for femoral tunnel overdrilling and the ability to retension the graft intraoperatively following cyclic loading and tibial fixation. These features may enhance graft positioning and optimize graft–bone contact.

However, the same adjustable mechanism that allows retensioning may also predispose to loop elongation and potential postoperative graft slippage, raising concerns regarding their long-term stability.^[3,4,9]

The utility of adjustable loop devices becomes particularly relevant in the context of anatomic ACL reconstruction, where shorter femoral tunnels are frequently encountered. In such scenarios, preservation of bone stock and maximization of the graft–bone interface are essential for biological incorporation, making adjustable loop systems a potentially advantageous option.^[3,4]

Biologically, bone–tendon healing in autografts typically occurs over a period of 6 to 12 weeks.^[4,8,10] During this critical phase, the mechanical integrity of the fixation construct is paramount in maintaining graft stability and preventing elongation or failure. In the present study, both fixed loop and adjustable loop devices demonstrated comparable functional outcomes during this early healing period, as well as at the 1-year follow-up, with no statistically significant differences observed in IKDC and Lysholm scores.

These findings are consistent with those reported by Ranjan et al., who observed comparable long-term outcomes between the two devices at 2 years, despite noting superior early results with fixed loop devices at 6 months.^[12] Similarly, Kassem et al. reported no significant difference in clinical outcomes between fixed and adjustable loop devices at a 2-year follow-up.^[1]

Biomechanical evidence regarding the comparative performance of these devices remains inconclusive. Chang et al. demonstrated that adjustable loop devices exhibit higher ultimate load to failure at time zero, whereas fixed loop devices show reduced cyclic displacement, suggesting superior resistance to elongation under repetitive loading conditions.^[13] These findings are supported by Houck et al., whose systematic review and biomechanical analysis also highlighted the trade-off between initial strength and resistance to cyclic elongation.^[14]

In contrast, several studies have raised concerns regarding the mechanical reliability of adjustable loop systems. Nye et al. reported that adjustable loop sutures may slide within the locking mechanism, leading to loop lengthening under load.^[15] Similarly, Petre et al.^[6] and Noonan et al.^[7] demonstrated that certain adjustable loop devices may undergo elongation exceeding 3 mm during cyclic testing, a threshold that may be considered clinically significant and potentially indicative of construct failure.

Although rare, unique complications such as late migration of adjustable loop cortical suspension devices have also been described. Williams et al. reported a case of device migration occurring two years postoperatively; however, this was not associated with clinical instability, and imaging confirmed an intact graft.^[16] Furthermore, improper deployment or malpositioning of the cortical button may result in soft tissue interposition, leading to local

tissue irritation, ischemic changes, and potential graft loosening.^[4,17]

Importantly, in the present study, no cases of graft failure, slippage, or significant postoperative complications related to fixation devices were observed in either group, supporting the clinical reliability of both fixation methods in the short term.

Implications, Strengths, and Limitations of the Study: The findings of the present study have important clinical implications. Given that no significant difference was observed in short-term functional outcomes between fixed loop and adjustable loop devices, surgeons may select the fixation method based on intraoperative requirements, anatomical considerations, and personal preference rather than concerns regarding clinical efficacy. Adjustable loop devices may be particularly advantageous in cases with shorter femoral tunnels, where preservation of bone stock and maximization of graft–bone contact are critical. Conversely, fixed loop devices may still be preferred in situations where greater resistance to cyclic displacement is desired, as suggested by biomechanical evidence.

A key strength of this study is its prospective randomized design, which minimizes selection bias and enhances the validity of the findings. The inclusion of a relatively adequate sample size and the use of standardized surgical techniques and rehabilitation protocols across both groups further strengthen the comparability of outcomes. Additionally, the use of validated functional outcome measures, such as IKDC and Lysholm scores, assessed by a blinded observer, adds to the methodological rigor.

However, certain limitations must be acknowledged. The follow-up duration was limited to one year, which may not be sufficient to evaluate long-term graft integrity, late complications, or differences in functional outcomes. The study also lacked radiological assessment, such as computed tomography (CT) or magnetic resonance imaging (MRI), which could have provided objective evaluation of femoral tunnel widening and graft incorporation. Furthermore, the absence of instrumented laxity testing (e.g., KT-1000 arthrometer) limits the ability to detect subtle differences in knee stability. Finally, as this was a single-center study, the generalizability of the findings may be limited.

CONCLUSION

Both fixed loop and adjustable loop femoral cortical suspension devices provide comparable short-term clinical outcomes in arthroscopic ACL reconstruction. Each technique has its own advantages and limitations, with no clear superiority demonstrated. Long-term studies with larger sample sizes are required for more definitive conclusions.

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