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Clinical outcomes of anterior cruciate ligament reconstruction using loop cruciate ligament fixation system

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ABSTRACT

Background: Anterior cruciate ligament (ACL) injuries cause knee instability and are associated with articular degeneration. ACL reconstruction is considered the primary treatment option for most cases. The study aimed to observe the clinical outcomes of ACL reconstruction using a Loop cruciate ligament fixation system.
Methods: This retrospective, multi-center study enrolled 187 patients who underwent arthroscopic ACL reconstruction using the LoopLoc CL fixation system and SlideRope Adjustable Loop (ArthroTEC, MJ Surgical, Ahmedabad, India). Among 187 patients, 179 received the targeted device for ACL reconstruction in the knee, seven received it for acromioclavicular joint fixation in the shoulder, and one received it for stabilization and repair in the foot/ankle. The patients were evaluated preoperatively, intraoperatively, and postoperatively at 1-month, 3-month, 12-month, 2-year, and 5-year follow-up periods. The evaluation was based on the international knee documented committee score (IKDC), visual analog scale score (VAS), Lysholm score, and knee injury and osteoarthritis outcome score (KOOS). The patient enrollment was conducted retrospectively, but the follow-up was planned to be carried out prospectively.
Results: The study found a significant improvement in the clinical outcomes with a low failure and complication rate among the patients. The mean deviation of patients with knee implantation showing IKDC score from baseline to 5-year was 17.58±2.56 to 91.48±3.05 ($p<0.0001$), while the VAS, Lysholm score, and KOOS also showed significant improvement. The study suggests that loop cruciate ligament may be a promising option for ACL reconstruction.
Conclusions: The study suggests that loop cruciate ligament may be a promising option for ACL reconstruction.

Keywords: Anterior cruciate ligament, Fixation, Loop, Reconstruction

INTRODUCTION

The anterior cruciate ligament (ACL) is the most important ligament functioning to stabilize the knee. These ligaments are essential for the passive restraint of anterior-posterior knee motion.[1] Disruption of ACL causes impairs the functioning and primordial joint degradation.[2] The partial or complete ACL tear results in a significant knee injury. Trauma in sporting activities such as football, soccer, or basketball results in approximately 70% of ACL injuries. These injuries lead to the risk of instability in daily and sporting activities, meniscal tear, or chondral damage.[3] ACL reconstruction is routinely performed to allow for a return to sport and to avoid the negative outcomes associated with nonoperative care of ACL ruptures, such as symptomatic knee laxity and future meniscal tears.[4] The main objective of ACL reconstruction is to manage sagittal instability, rotational instability, and anterior laxity. Though, there are several surgical techniques to treat ACL, modern surgical techniques may not at all times imparts sufficient control of rotational stability.[5] For patients who underwent ACL reconstruction, the outcomes to be

considered are residual rotatory knee instability and the development of knee osteoarthritis untimely after the reconstruction procedure is a growing concern.[6,7] ACL reconstruction performed at an early period assists in an early return to sport and work and is more economical. The more gap between the duration of injury and surgery correlated with an increased prevalence of meniscus and cartilage injuries thus, ACL reconstruction should be done within 12-month of the injury.[8] An early ACL reconstruction is now regarded as better option for the treatment of the injury and produces significant clinical results.[9] Tendon grafts that are most commonly used are autologous bone-patellar tendon-bone, allograft, and hamstring tendon.[10] The loop fixation system offers several potential advantages over other fixation methods, such as shorter operative time and reduced risk of graft slippage.[11] This technique involves using a continuous loop of suture material, which is passed through the graft and then secured to the bone tunnels on either side of the joint. The suture loop is then tied down, providing stable fixation of the graft within the bone tunnels.[12]

The experimental result shows that loop loosening caused by cyclic loads may be a problem when using adjustable-length cortical fixation devices, but not when using fixed-loop cortical fixation devices.[13] In theory, adjustable-length cortical fixation devices allow the bone-tendon junction to be adjusted at the femoral tunnel aperture under arthroscopic direct vision, which conventional fixed-loop devices could not do consistently. Furthermore, adjustable-length cortical fixation devices can avoid specific interference screws difficulties such as intra-articular migration and fixation loss due to screw-tunnel divergence.[14]

The purpose of the study was to observe the clinical outcomes of ACL reconstruction using a LoopLoc CL fixation system and SlideRope Adjustable Loop cruciate ligament fixation system.

METHODS

The study was designed as a retrospective, single-arm, multi-center, observational, and post-market clinical follow-up study carried out at Arthocare Hospital, Bodakdev, Ahmedabad and Shreedhar Hospital, Vastral, Ahmedabad. The enrolment of the patients in the study was between the duration of January 2017 to August 2022. The enrolment of patients was done retrospectively and the follow-up was planned to conduct prospectively. The study adhered to the guidelines of the International Council for Harmonization of Technical Requirements for Pharmaceuticals for Human Use (ICH) - Good Clinical Practice (GCP), the International Organization for Standardization (ISO) 14155:2020, and relevant local regulations. The study was carried out in compliance with the declaration of Helsinki. A total of 187 patients were enrolled in the interventional group in which a minimum of one patient was bifurcated for shoulder, foot, and ankle. Patients were evaluated preoperatively, intraoperatively, and postoperatively at 1-month, 3-month, 12-month, 2-year, and 5-year for this safety study, with longer follow-up planned for early efficacy measures of safety study and to justify the continued follow-up.

Inclusion criteria

For ACLR, male or female subjects between the age of ≥18 to ≤50 years at the time of surgery with an indication of tendon and ligament fixation in orthopaedic reconstruction procedure were considered to be the part of study. Subjects with a minor meniscus tear, osteoporosis (osteoporosis stage 1 and stage 2) and have provided consent to participate in the study by signing an approved informed consent form along with complying all the study follow-up procedures and requirements were included for the surgery.

Exclusion criteria

Participation of the subjects with inflammatory arthritis, multi-ligament tear, bucket handle tear, meniscal repair case with an extensive meniscal tear, and subjects with revision cases or any implantation for non-indicated conditions like inadequate bone quality, hypersensitivity to allergic conditions, acute localized infections, patients with the limited blood supply in knee/shoulder/foot & ankle with unstable physical and/or mental health conditions were excluded from the study.

Device description

LoopLoc CL fixation system (ArthroTEC, MJ Surgical, Ahmedabad, India) and SlideRope adjustable Loop (ArthroTEC, MJ Surgical, Ahmedabad, India) is a continuous loop of suture braid that eliminates the need for knot tying and allows for a larger portion of graft to reside in the tunnel. It is preloaded with UFiber (USP #5 lead and USP #5 flipping) for added procedure efficiency. Loop accommodates various lengths of graft. Single size titanium button is available with multiple pre-measure loop sizes of 7, 8, 10, 12, 15, 20, 25, 30, 35, and 40mm lengths. It promotes insertion site healing and rests on the cortical bone surface. The loop is used in single-bundle soft tissue fixation, double-bundle soft tissue fixation, and bone tendon fixation. SlideRope tibial attachable disk (TAD) and two different varieties of SlideRope ankle syndesmosis (AS) for fractured and non-fractured cases are used for the implantation in the foot/ankle. For the shoulder, SlideRope acromioclavicular joint (AC) was used**.**

Surgical technique

Patients underwent conventional arthroscopic examination through the anterolateral and anteromedial portals for the confirmation of a complete ACL tear. After that, the hamstring tendon was harvested and two double-bundle grafts were prepared. By the outside-in technique of femoral bone, the tunnels were created. Using the femoral

aimer, two guide wires were inserted from outside the lateral cortex of the femur to footprint the anteromedial (AM) and posterolateral (PL) bundles of the ACL. After confirming the desired position of the two tips of the wire, the femoral tunnel was at 110° - 120° of knee flexion over the guidewires from the outside of the lateral femoral cortex, which allows the passage of a retrograde drill, which creates a 15 mm long socket. The tibial AM tunnel was created just posterior to the anterior margin of the ACL, remnant, and that of the PL tunnel was created approximately 12-15 mm anterior to the anterior border of the PCL while referring to the attachment of the anterior horn of the lateral meniscus. After the two femoral and two tibial tunnels were created, each graft was passed through the tunnel. LoopLoc CL fixation system and SlideRope adjustable Loop was used for the femoral fixation device in almost all the cases according to previously reported graft configuration with cannulated titanium/polyether ether ketone (PEEK) interference screw (ArthroTEC, MJ Surgical, Ahmedabad, India). The tibial post-fixation screw (ArthroTEC, MJ Surgical, Ahmedabad, India) was positioned superiorly on the tunnel to position the graft inferiorly. Tibial fixation was performed using a tibial suture disk with D'hole/round hole (ArthroTEC, MJ Surgical, Ahmedabad, India). After the graft fixation, the knees are passively extended and flexed from 0° to 90° ten times to reveal the loss of initial tension that would occur at the beginning of the initial stages of rehabilitation.

Study endpoints

The primary endpoint of the study was the IKDC score for the patients implanted with LoopLoc and SlideRope in the knee. IKDC score evaluation form contains 3 domains that are symptoms, including pain, stiffness, swelling, locking/catching, and giving way; sports and daily activities; and current knee function and knee function before knee injury (not included in the total score). Possible score ranges from 0-100, where 0 represents the highest level of symptoms and 100 represents the lowest level of symptoms. The secondary endpoints for knee implants were the visual analog scale (VAS) that measures the intangible quantities of pain, quality of life, and anxiety with a line of 100 mm in length with anchor descriptors such as "no pain" and "worst pain imaginable, Lysholm score which represents the subjective outcome score used by physicians to determine improvement in the injured or post-surgical knee, and knee injury and osteoarthritis outcome (KOOS) score that is designed to assess short and long-term patient-relevant outcomes following a knee injury that is an overall score of 0 to 100 calculated and graded based on 8 domains: limp, locking, pain, stair climbing, support, instability, swelling, and squatting.

For the patients implanted with the study device in the shoulder, the functional outcomes were measured using VAS, University of California at Los Angeles (UCLA) shoulder score that has five sub-scales made up of: active forward elevation and strength (physician reported), pain, satisfaction, and function, constant Murley score (CMS) that represents multi-item functional scale assessing pain, activities of daily life (ADL), ROM and strength of the affected shoulder, and lastly acromioclavicular joint (ACJ) specific Taft score that grades results after conservative and surgical treatment of AC joint.

The implant in foot/ankle evaluation was performed by foot and ankle outcome score (FAOS) measuring symptoms and functional limitations of the foot and ankle and Manchester-Oxford Foot Questionnaire assessing the outcome following foot/ankle corrective surgery. For the evaluation of the clinical outcomes at 1-month, 3-month, 12-month, 2-year, and 5-year, the assessments of adverse events (AE), adverse device effects (ADE), and quality of life (EQ-5D) were performed.

Sample size and statistical analysis

A sample size of 171 achieves 90% power to detect a mean of paired differences of 4.2 with a standard deviation of differences of 16.7 and with a significance level (alpha) of 0.05 using a two-sided paired t-test. Considering the attrition rate of 10%, around 190 subjects were required to be enrolled in the study.[15] Since the device was indicated to implant shoulder and foot/ankle in much smaller populations, the sample size was calculated based on the knee implants. Depending on the patient's data collected, all statistical analyses were performed. Categorical variables were summarized by frequency distribution for each categorical component (relative frequencies and percentage). All the statistical analysis were performed using statistical package for the social sciences (SPSS) v.20. Results were reported as mean±standard deviation for continuous variables and as number percentage for nominal variables. For pre-post differences changes, ordinal variables were tested using the Wilcoxon test, and for continuous variables, the paired t-test was used. The chi-square test or Fisher's exact test was used for comparing categorical variables' frequency. Results were significant at $p<0.05$. The present study does not report any removal or replacement of loop for 187 patients till 24 months FU, so we have 100% survival ship of implanted knee, shoulder and foot/ankle.

RESULTS

The retrospective data were collected from 187 patients. The patients treated with LoopLoc and SlideRope had an average age of 35.59±10.73 years for the device implanted the knee, 49.29±9.38 years for the device implanted in the shoulder, and 52-year for the device implanted in foot/ankle. Out of these patients, 179 patients were implanted with the loop in the knee, seven patients were implanted with loop in the shoulder and only one implant of the loop was performed in the foot/ankle. Out of 179 patients for knee, 131 (73.18%) were male and 48 (26.82%) were female. There were 175 (97.77%) patients where there was no previous history of surgery for the device implanted in the knee joint, 1 (0.56%) patient had a history of a previous surgery that was not related to the

study procedure, 2 (1.12%) patients had a history of surgery in the right shoulder joint which was not significant and 1 (0.56%) patient had the surgical operation performed in the right knee joint but it also showed no significance as the patient was operated for the surgical procedure in the left knee in the present study. The patients implanted with loop in the shoulder and foot/ankle had no history of previous surgery. Table 1-3 show the summary of demographic characteristics for knee, shoulder, and foot/ankle implants.

Table 1: Summary of demographic characteristics for knee implant (n=179).

Parameter	
Age, Years, Mean ± SD	35.59±10.73
Gender, n (%)	
Male	131 (73.18)
Female	48 (26.82)
History of previous surgery, n (%)	
No	175 (97.77)
Yes	01 (0.56)
Side of implant, n (%)	
Left	86 (48.04)
Right	90 (50.28)
Both	03 (1.68)
The mean size of loop±SD	14.61±2.93
Size if loop (mm), n (%)	
7	01 (0.56)
8	79 (44.13)
10	16 (8.94)
12	12 (6.70)
15	67 (37.43)
20	16 (8.94)

Table 2: Summary of demographic characteristics for shoulder implant (n=7).

Parameter	
Age, Years, Mean ± SD	49.29±9.38
Gender, n (%)	
Male	03 (42.86)
Female	04 (57.14)
History of previous surgery, n (%)	
No	07(100)
Yes	00 (00.00)
Side of implant, n (%)	
Left	04 (57.14)
Right	03 (42.86)

Table 4 presents the data of patients with knee implantation in IKDC score was significant (p<0.0001) from baseline with the mean deviation of 17.58±2.56 to 91.48±3.05 at the 5-year follow-up period. The gradual decrease in the VAS from baseline to the follow-up of 2-year shows the mean difference from 7.89±0.91 to 2.32±1.98 depicting the improvement in the patient condition and statistically significant outcomes (p<0.0001). Lysholm score observed statistically significant (p<0.0001) at baseline was 38.40±3.77 and 87.89±3.64 at 5-year follow-up.

Table 3: Summary of demographic characteristics for foot/ankle implant (n=1).

Parameter	
Age, Years, Mean ± SD	52
Gender, n (%)	
Male	01 (100)
Female	00 (00.00)
History of previous surgery, n (%)	
No	01 (100)
Yes	00 (00.00)
Side of implant, n (%)	
Left	01 (100)
Right	00 (00.00)

Table 4: Procedural characteristics for knee implant.*

Parameter	Follow-up period	Mean	SD	p-value
International knee documentation committee (IKDC) score	Baseline	17.58	2.56	NA
	1-month	40.72	2.55	<0.0001
	3-month	51.72	3.10	<0.0001
	12-month	74.01	6.76	<0.0001
	2-year	84.33	3.25	<0.0001
	5-year	91.48	3.05	<0.0001
Visual analog scale (VAS)	Baseline	7.89	0.91	NA
	1-month	5.27	1.15	<0.0001
	3-month	2.69	1.70	<0.0001
	12-month	2.32	1.84	<0.0001
	24-month	2.32	1.98	<0.0001
Lysholm Score	Baseline	38.40	3.77	NA
	1-month	48.45	3.76	<0.0001
	3-month	58.38	3.94	<0.0001
	12-month	68.00	3.62	<0.0001
	2-year	77.91	3.52	<0.0001
	5-year	87.89	3.64	<0.0001
Knee injury and osteoarthritis outcome (KOOS) score	Baseline	36.30	3.68	NA
	1-month	48.47	2.98	<0.0001
	3-month	60.44	3.54	<0.0001
	12-month	72.34	4.37	<0.0001
	2-year	79.39	3.36	<0.0001
	5-year	87.56	3.04	<0.0001
Quality of life EQ-5D	Baseline	27.10	4.69	NA
	1-month	44.26	2.47	<0.0001
	3-month	53.96	2.11	<0.0001
	12-month	69.27	3.13	<0.0001
	2-year	84.20	2.47	<0.0001
	5-year	87.56	4.21	<0.0001

*Follow-up is ongoing

Table 5: Procedural characteristic for shoulder implant*.

Parameter	Follow-up period	Mean	SD	p-value
Visual analog score (VAS)	Baseline	8.86	0.69	NA
	1-month	7.33	0.52	<0.0015
	3-month	5.00	1.15	<0.0004
	12-month	3.50	0.55	<0.0001
University of California Los Angeles Score (UCLA)	Baseline	4.29	1.11	NA
	1-month	10.71	1.60	<0.0001
	3-month	16.57	1.72	<0.0001
	12-month	23.50	1.52	<0.0001
	2-year	30.33	1.53	0.0005
Constant murley shoulder score (CMS)	Baseline	24.86	1.35	NA
	1-month	42.29	1.60	<0.0001
	3-month	53.29	1.80	<0.0001
	12-month	69.00	1.41	<0.0001
	2-year	83.67	1.53	<0.0001
Acromiocla vicular joint (ACJ) specific taft score	Baseline	26.00	0.82	NA
	1-month	43.14	1.35	<0.0001
	3-month	53.86	2.41	<0.0001
	12-month	69.17	1.47	<0.0001
	2-year	83.67	2.08	0.0001
Quality of life: EQ-5D	Baseline	21.57	3.31	NA
	1-month	41.86	1.77	<0.0001
	3-month	52.86	2.12	<0.0001
	12-month	69.00	1.26	<0.0001
	2-year	83.33	0.58	0.0004

*Follow-up is ongoing

Table 6: Procedural characteristic for foot/ankle implant*.

Parameter	Follow-up period	Score	Comment
Visual analog score (VAS)	Baseline	9	Substantial improvement in patient condition is observed
	1-month	8	
	3-month	6	
Parameter	Follow-up period	Score	
Foot and ankle outcome score (FAOS)	Baseline	26	
	1-month	45	
	3-month	56	
Parameter	Follow-up period	Score	
Manchester-oxford foot questionnaire	Baseline	35	
	1-month	48	
	3-month	70	
Parameter	Follow-up period	Score	
Quality of life: EQ-5D [%]	Baseline	24	
	1-month	43	
	3-month	55	

*Follow-up is ongoing

According to the KOOS score, the mean deviation observed statistically significant (p<0.0001) at baseline was 36.30±3.68 that gradually increased up to 87.56±3.04 at the 5-year follow-up. The quality of life showed improvement with statistical significance (p<0.0001) and was determined starting from baseline to 5-year with the mean deviation from 27.10±4.69 to 87.56±4.21.

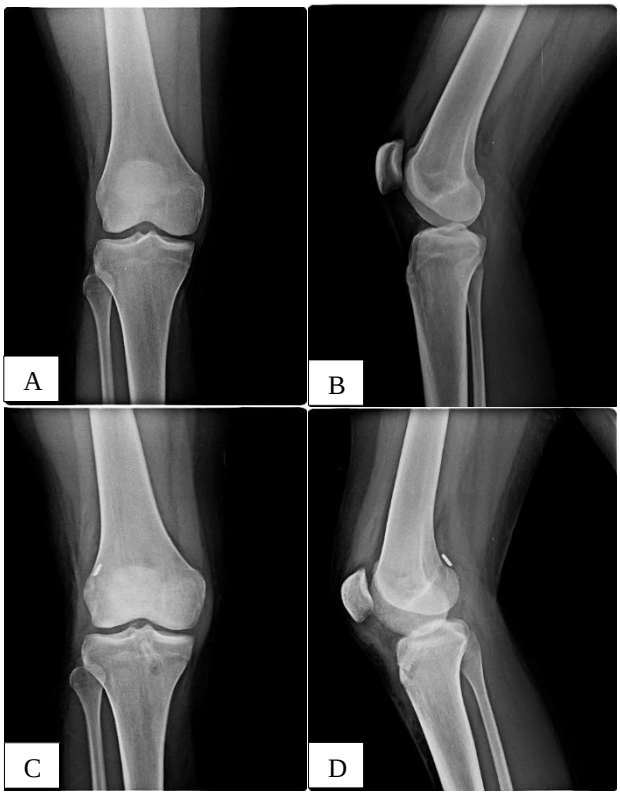

Figure 1: A) Pre-operative radiograph before ACL reconstruction (rt), B) Pre-operative radiograph before ACL reconstruction (lt), C) Post-operative radiograph before ACL reconstruction (rt) with loop implant, D) Post-operative radiograph before ACL reconstruction (lt) with loop implant.

Patients who had received shoulder implants showed a statistically significant improvement in their pain levels from baseline to the 12-month follow-up. The baseline Visual Analog Scale (VAS) score had a mean deviation of 8.86±0.69, indicating severe pain in the shoulder joint. However, at the 12-month follow-up, the VAS score had significantly decreased to 3.50±0.55 (p<0.0001), indicating a substantial reduction in pain levels. The outcomes of UCLA score was statistical significant (p=0.0005) with the mean deviation observed at baseline being 4.29±1.11 to 30.33±1.53 at 2-yearfollow-up. In the case of CMS score was significant (p<0.0001) at the baseline 24.86±1.35 and 83.67±1.53 at 2-year. Similarly, the ACJ score also showed statistically significance (p<0.0001) from baseline to 2-year. The mean of ACJ score at baseline was 26.00±0.82, which increased gradually up to 83.67±2.08 at 2-year. Quality of life was

significantly improved from baseline is 21.57±3.31 to 83.33±0.58 at 2-year follow-up (p=0.0004).

Patients with foot/ankle implant show a VAS of 9 at a baseline and 6 at the follow-up of 3-month, showing a substantial improvement in patient condition. The FAOS score at baseline was 26 and 56 at 3-month. Similarly, the Manchester-Oxford Foot Questionnaire at the baseline gives a value of 35 and 70 at 3-month, demonstrated the remarkable improvement in patient condition. However, the quality of life observed at baseline was 24, and 55 at 3-month, it was evidenced the gradual enhancement in the patient.

The pre-operative radiograph of a patient who underwent ACL reconstruction and the post-operative radiograph of a patient with Loop is depicted in Figure 1 (A-D).

DISCUSSION

The most important finding of this retrospective study were the good clinical results achieved at 12-month after acute ACLR. ACL injury represents a common orthopaedic concern that could lead to the early development of post-traumatic osteoarthritis, if not properly treate.[16] From this perspective, reconstruction parameters including graft choice, placement, fixation, tension as well as the general laxity, affects the biomechanics of knee and possibly influences the outcome of the surgery itself.[17] In our study, assessments and strength testing were performed at multiple intervals. The data collection and analysis were completed over a specific period, during which the study participants underwent assessments and strength testing at several time points. The scores evaluated the knee's functionality, quality of life, and physical activity of each individual. After 12-month following the surgery, all patients were able to walk on their own, put their full body weight on the knee that was operated on, and expressed no pain in the knee joint. They were also able to complete their daily activities without any problems or limitations.

Arthroscopic ACL reconstruction has become the standard care for the ACL-deficient knee.[16,17] Devices used for graft fixation in ACL reconstruction have been identified as a contributing factor to bone tunnel enlargement.[18] The findings of this study demonstrated a significant improvement in clinical outcomes at 5-year postoperatively, compared to preoperative values. These results highlight the potential benefits of using LoopLoc and SlideRope devices for ACL reconstruction procedures, as they can lead to positive long-term outcomes for patients. This study sheds light on the effectiveness of these methods and provides evidence for their use in ACLR surgeries. Loop type of fixation system is currently the most accepted device for the fixation of soft tissue grafts in arthroscopic ACLR.[19] Theoretically, this may lead to excessive graft motion in the tunnel, tunnel widening, and delay in graft tunnel healing. It has been shown that new bone ingrowth around the tendon graft is inversely related to the magnitude of graft motion within the tunnel.[10] The use of adjustable-loop device avoids excessive over drilling into the bone tunnel and has the potential of elongation during in vitro cyclic loading, leading to loss of graft tension that may result in the graft status under in vivo condition.[20-22]

Several clinical studies have reported positive outcomes with the application of femoral cortical suspensory fixation devices in ACL reconstruction, including both fixed loop and adjustable loop devices. These devices function by securing the graft within the femoral tunnel via the cortical bone, thus restoring stability to the knee joint.[10,23,24] Ranjan et al evaluated and compared the functional outcomes and knee stability following ACL reconstruction using fixed loop (EndoButton CL) and adjustable loop (TightRope RT). The results showed that, 6-month post-operative, the EndoButton CL group (n=52) had better IKDC and Lysholm scores than the TightRope RT group (n=50). However, at the final follow-up of 2-year, the outcomes between the two groups were similar. These findings suggest that while the EndoButton CL device may offer initial advantages, the use of the TightRope RT device may result in comparable long-term clinical outcomes.[10] Kim et al evaluated the clinical and radiographic results, stability, and bone tunnel enlargement following ACL reconstruction using a ToggleLoc with a zip loop as the adjustable-loop device that lead to positive clinical outcomes and improved patient satisfaction following ACL reconstruction.[23] The study conducted by Sheth et al evaluated the outcomes of ACL reconstruction using fixed and adjustable suspensory devices for femoral side graft fixation. The study results demonstrated that both groups had excellent clinical outcomes, with no significant difference observed. Postoperative Lysholm scores were found to be 94.23 in the fixed loop group and 94.32 in the adjustable loop group. Similarly, the IKDC scores were 92.03 in the fixed group and 92.16 in the adjustable group. Both group also showed a significant improvement in knee instability, as assessed by Lachman test and anterior drawer tests. The VAS score improved from 5 to 3 in the fixed loop group and from 4 to 3 in the adjustable loop group. Overall, the study provided valuable insights into the use of fixed and adjustable suspensory devices for femoral side graft fixation in ACL reconstruction procedures.[24] Similarly, in our study, we observed significant improvements in functional outcomes of patients who received ACL reconstruction using the LoopLoc CL fixation system and SlideRope adjustable Loop.

Our findings indicate that this method of ACL reconstruction is associated with improved function and satisfaction among patients. Different scores at different timelines were studied and it was observed that there was an improvement in the patient’s condition. No adverse effects were observed from the date of enrolment of the patient till the date of follow-up.

This study had some limitations. First, the results did not take into account biological healing in a real clinical situation, which is very important in stabilizing the construct and lack of measurement of tunnel widening at final follow-up. It only evaluated the behavior of the implants in isolated conditions, which may not provide an accurate representation of how they perform in the context of an ACL reconstruction when considering the functional outcomes of the devices. We felt these limitations were acceptable to allow for comparisons of our results with prior studies.

CONCLUSION

ACL injuries cause recurrent instability that further led to chondral and medial meniscus tears. In this research, ACL reconstruction using the Loop fixation system has a better diagnosis with a minimum decline rate with a low failure and complication rate at a mean follow-up and suggests that loop cruciate ligament may be a promising option for the treatment of patients with an injured knee. It can serve as an acceptable choice for fast recovery of the anterior cruciate ligament in the knee. It significantly improves the medial, sagittal, and rotatory stability of the knee at short-term follow-up and long-term follow-up.

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REFERENCES

1. Prado M, Nazario S, Bergamim JS, Nasrala ML, Neto EN, Felippe LA, et al. Anterior cruciate ligament: anatomy and biomechanics. J Health Sci. 2019;21(2):166-9.
2. Kaeding CC, Léger-St-Jean B, Magnussen RA. Epidemiology and diagnosis of anterior cruciate ligament injuries. Clin Sp Med. 2017;36(1):1-8.
3. Décary S, Fallaha M, Belzile S, Martel-Pelletier J, Pelletier JP, Feldman D, et al. Clinical diagnosis of partial or complete anterior cruciate ligament tears using patients' history elements and physical examination tests. PLoS One. 2018;13(6):e0198797.
4. Hughes JD, Vaswani R, Gibbs CM, Tisherman RT, Musahl V. Anterior cruciate ligament reconstruction with a partial-thickness quadriceps tendon graft secured with a continuous-loop fixation device. Arthros Tech. 2020;9(5):e603-9.
5. Akmese R, Ovali SA, Celebi MM, Malatyali B, Kocaoglu H. A surgical algorithm according to pivot-shift grade in patients with ACL injury: a prospective clinical and radiological evaluation. Orthopaedic J Sp Med. 2021;9(8):23259671211025494.
6. Chiba D, Gale T, Nishida K, Suntaxi F, Lesniak BP, Fu FH, et al. Lateral extra-articular tenodesis contributes little to change in vivo kinematics after anterior cruciate ligament reconstruction: a randomized controlled trial. The Am J Sports Med. 2021;49(7):1803-12.
7. Khandha A, Manal K, Wellsandt E, Capin J, Snyder-Mackler L, Buchanan TS. Gait mechanics in those with/without medial compartment knee osteoarthritis 5 years after anterior cruciate ligament reconstruction. J Orthop Res. 2017;35(3):625-33.
8. von Essen C, Eriksson K, Barenius B. Acute ACL reconstruction shows superior clinical results and can be performed safely without an increased risk of developing arthrofibrosis. Knee Surg Sp Traumatol Arthrosc. 2020;28(7):2036-43.
9. Vaishya R, Agarwal AK, Ingole S, Vijay V. Current trends in anterior cruciate ligament reconstruction: a review. Cureus. 2015 Nov 13;7(11).
10. Ranjan R, Gaba S, Goel L, Asif N, Kalra M, Kumar R, et al. In vivo comparison of a fixed loop (EndoButton CL) with an adjustable loop (TightRope RT) device for femoral fixation of the graft in ACL reconstruction: A prospective randomized study and a literature review. J Orthop Surg. 2018;26(3):2309499018799787.
11. Nickoli MS, Sheean AJ, Albers MB, Fu FH. Complications with fixation devices in anterior cruciate ligament surgery. in complications in orthopaedics: Sports Medicine. Elsevier. 2019:59-64.
12. Choi HG, Jeong HW, Park SB, Shim SJ, Lee YS. Additional tying on the adjustable-loop device improves the outcomes of anterior cruciate ligament reconstruction using hamstring autograft. Knee Surg Sp Traumatol Arthrosc. 2022;30(11):3673-80.
13. Kusano M, Kazui A, Uchida R, Mae T, Tsuda T, Toritsuka Y. Loop length change of an adjustable-length femoral cortical suspension device in anatomic rectangular tunnel anterior cruciate ligament reconstruction with a bone–patellar tendon–bone graft and associated clinical outcomes. Arthroscopy: J Arthrosc Rel Surg. 2018;34(11):3063-70.
14. Matsuo T, Kusano M, Uchida R, Tsuda T, Toritsuka Y. Anatomical rectangular tunnel anterior cruciate ligament reconstruction provides excellent clinical outcomes. Knee Surg Sp Traumatol Arthrosc. 2022;30(4):1396-403.
15. Saccomanno MF, Shin JJ, Mascarenhas R, Haro M, Verma NN, Cole BJ, et al. Clinical and functional outcomes after anterior cruciate ligament reconstruction using cortical button fixation versus transfemoral suspensory fixation: a systematic review of randomized controlled trials. Arthroscopy: J Arthrosc Rel Surg. 2014;30(11):1491-8.
16. Ardern CL, Webster KE, Taylor NF, Feller JA. Return to sport following anterior cruciate ligament reconstruction surgery: a systematic review and meta-analysis of the state of play. British J Sp Med. 2011;45(7):596-606.
17. Lai CC, Ardern CL, Feller JA, Webster KE. Eighty-three per cent of elite athletes return to preinjury sport after anterior cruciate ligament reconstruction: a systematic review with meta-analysis of return to

sport rates, graft rupture rates and performance outcomes. British J Sp Med. 2018;52(2):128-38.
18. Choi NH, Yang BS, Victoroff BN. Clinical and radiological outcomes after hamstring anterior cruciate ligament reconstructions: comparison between fixed-loop and adjustable-loop cortical suspension devices. Ame J Sp Med. 2017;45(4):826-31.
19. Lubowitz JH, Amhad CH, Anderson K. All-inside anterior cruciate ligament graft-link technique: second-generation, no-incision anterior cruciate ligament reconstruction. Arthroscopy: J Arthrosc Rela Surg. 2011;27(5):717-27.
20. Eguchi A, Ochi M, Adachi N, Deie M, Nakamae A, Usman MA. Mechanical properties of suspensory fixation devices for anterior cruciate ligament reconstruction: comparison of the fixed-length loop device versus the adjustable-length loop device. The Knee. 2014;21(3):743-8.
21. Lubowitz JH, Amhad CH, Anderson K. All-inside anterior cruciate ligament graft-link technique: second-generation, no-incision anterior cruciate ligament reconstruction. Arthroscopy: J Arthrosc Rela Surg. 2011;27(5):717-27.
22. Noonan BC, Dines JS, Allen AA, Altchek DW, Bedi A. Biomechanical evaluation of an adjustable loop suspensory anterior cruciate ligament reconstruction fixation device: the value of retensioning and knot tying. Arthroscopy: J Arthrosc Rela Surg. 2016;32(10):2050-9.
23. Kim Y, Kubota M, Muramoto K, Kunii T, Sato T, Inui T, et al. Clinical and radiographic results after ACL reconstruction using an adjustable-loop device. Asia-Pacific J Sports Med Arthrosc Rehab Technol. 2021;26:32-8.
24. Sheth H, Salunke AA, Barve R, Nirkhe R. Arthroscopic ACL reconstruction using fixed suspensory device versus adjustable suspensory device for femoral side graft fixation: What are the outcomes?. J Clin Orthop Tr. 2019;10(1):138-42.

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