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RESEARCH ARTICLE
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FUNCTIONAL OUTCOME OF ARTHROSCOPIC ACL INSIDE ACL RECONSTRUCTION VERSUS COMPLETE TIBIAL TUNNEL

Muhammad Imran Haider[1*], Adnan Nazir[2], Muhammad Imran Anjum[3], Ahmad Jamal[4], Muhammad Adeel Razzaque[5], Zahid Iqbal[6]

[1*]Assistant Professor Orthopedics, Nishtar Medical University, Multan - Pakistan
[2]Senior Registrar Orthopaedic Unit, Bahawal Victoria Hospital, Bahawalpur - Pakistan
[3]Senior Registrar Orthopaedic Surgery Victoria Hospital, Bahawalpur - Pakistan
[4]Senior Registrar Orthopaedics, Nishtar Hospital, Multan - Pakistan
[5]Assistant Professor Orthopaedic, Bakhtawer Amin Hospital, Multan - Pakistan
[6]FCPS Ortho, Medical Officer, Orthopedic Unit, Bahawalpur Victoria Hospital, Bahawalpur - Pakistan

[*]**Corresponding Author:** Muhammad Imran Haider,
[*]Assistant Professor Orthopedics, Nishtar Medical University, Multan - Pakistan
Email address: drmihqaisrani@gmail.com

Abstract

Background: Anterior cruciate ligament (ACL) injuries are a common occurrence in the field of orthopedics and sports medicine, often requiring surgical intervention to restore knee stability as well as activity.

Objective: This study's objective was to compare the results of a large patient cohort undergoing ACL restoration utilizing the Complete Tibial Tunnel (CTT) approach with the All Inside Technique (AIT).

Methodology: A research conducted at many medical facilities from January 2021 to July 2023 included 80 patients, ages 18 to 45, who had MRI-confirmed ACL injuries. Two groups of patients had All Inside Group (AIG) and Complete Tibial Tunnel Group (CTTG) ACL restoration, with different surgical procedures used according to the surgeon's discretion. Standard procedures were followed throughout postoperative rehabilitation, and statistical analysis was used to evaluate results using t-tests, chi-square tests, descriptive statistics, hypothesis testing, and Kaplan-Meier survival analysis. Significance was defined as $p<0.05$.

Results: The research assessed the baseline characteristics, injuries, surgeries, and complications of the two groups, which consisted of 38 persons in the AI group (mean ± SD age: 24.7 ± 10.3 years) and 42 individuals in the CTTG group (mean ± SD age: 20.2 ± 6.9 years).Comparable results were seen for the Patient-Reported Outcomes (PRO) in the most frequent follow-up: Tegner activity score (6.3 vs. 5.7, with a p-value of 0.042), IKDC score (92.7 vs. 89.2, with a p-value of 0.387), and Lysholm score (92.6 vs. 90.8, with a p-value of 0.593). In general 13 of 42 participants (30.95%) in the CTTG and 4 of 38 participants (10.52%) in the AIG failed before the end of follow-up (P= 0.300). While the CTTG and AIG had a mean return to sport of 9.9 months and 11.5 months (P=0.038), respectively.

Conclusion: In conclusion, the study compared ACL reconstruction techniques, favoring the All Inside Technique (AIG) due to its slightly higher Tegner score, lower failure rate, and a slightly longer return to sport time, highlighting its potential as a promising surgical approach for improved patient outcomes.

Keywords: Arthroscopic ACL Reconstruction, All Inside Technique, Complete Tibial Tunnel Technique, Patient-Reported Outcomes (PROs)

Introduction:

In the fields of orthopedics and sports medicine, anterior cruciate ligament (ACL) injuries are frequent and often need surgical intervention to restore knee stability and function. The less invasive features of arthroscopic ACL restoration and its promise to enhance patient outcomes have made it a popular surgical method. Nonetheless, there is still disagreement about whether arthroscopic repair technique is best (1-6). The All inside (AI) approach and the Complete tibial tunnel (CTT) technique are two frequently utilized arthroscopic ACL restoration procedures. This study investigates their functional results.

Suspensory fixation devices are used in the AI approach, which minimizes bone removal and may lower the likelihood of problems related to the tibial tunnel (7-9). The CTT approach, on the other hand, depends on building a CTT and fixing the graft with interference screws. The surgical intricacy, graft stability, and postoperative rehabilitation of these techniques vary, and these factors may have an impact on the patients' final functional results (10-12).

It is imperative that surgeons and patients alike comprehend the distinctions in functional results between these two procedures in order to make well-informed judgments about ACL restoration. In this large group of patients undergoing hamstring autograft ACLR with the AI technique compare to those undergoing the ACLR procedure with a CTT technique, the aim of the research was to evaluate and compare patient-reported outcomes, or PROs, with clinical results.

Research Methodology

The study was conducted from January 2021 to July 2023 at Nishtar Medical University in Multan, Qaisrani Medical Center in Multan, and Bahawal Victoria Hospital in Bahawalpur. Following permission from the institution's ethical committee, patients between the ages of 18 and 45 who had isolated ACL injuries verified by MRI both medically and surgically were included to the experiment. Patients with meniscal injuries, bone injuries, pre-existing osteoarthritis, previous knee surgery, and neuromuscular abnormalities were excluded. In all, eighty patients participated in the trial, and written and verbal consent were acquired. The AI technique approach or the CTT method was assigned to each of the two groups of participants.

Surgical technique

Every patient in this research had primary ACLR utilizing either a CTT approach or AI procedure, according on the surgeon's preference. In all-inside reconstructions, a low-profile reamer was used to produce the femoral socket, which had to be at least 20 mm long. This was done either anterogradely from inside the joint or retrogradely using an Arthrex FlipCutter, leaving a posterior wall that measured one millimeter. The first ACL fiber insertion location was marked with a groove using the transportal offsets guidance. A Flip Cutter was employed and positioned at the lateral meniscal anterior horn connection to form a retrograde tibial socket. Using TightRope reducing strands, the graft was advanced into the femur and inserted into the joint via the anteromedial portal after the femoral button on the adjacent femoral cortex was activated. Once the proximal component of the graft was inserted into the tibial socket and the Tight Rope button on the medial tibial cortex was depressed, the knee was flexed and stretched. Stress was applied to the whole construct during full extension, and the graft was retensioned on both the tibial and femoral sides.

The CTT approach created a femoral socket that was at least 20 mm long by using a low-profile reamer. The direct ACL fibers were introduced into the socket at the position of its 2-mm proximal wall, and the tibial tunnel was made using a stiff reamer or FlipCutter. The graft was transmitted via the tunnel, which was placed in close proximity to the lateral meniscal anterior horn, and crossed the intra-articular space to enter the femoral socket. Cortical fixation devices such as Endobutton, TightRope, or RetroButton were employed to attach the graft, and tensioning was done during full knee extension. Subsequently, the knee was extended and flexed, and it was fastened with a tibial Bio-Compression Screw that was precisely the correct size for the tunnel. The patients had a standardized postoperative rehabilitation program that comprised quick recovery of knee extension to preoperative levels, returning to jogging three months after the treatment, and cutting and pivoting sports activities once again nine to twelve months later.

Statistical Analysis

The quadriceps muscular strength and functional outcome scores were analyzed using independent and paired sample t-tests, while the categorical data was assessed using the chi-square test. The patient's characteristics, such as their demographics, follow-up dates, complications, and outcomes, were described using descriptive statistics. To find significant differences between groups and variables, many hypothesis tests were run, such as the Wilcoxon rank-sum test and the Fisher's exact test. Time to failure was examined using Kaplan-Meier survival analysis. In the study, P values less than 0.05 were deemed statistically significant.

Results

In that study, 42 participants in the CTTG and 38 patients in the AIG were included. Table 1 presents the demographic characteristics of both groups. Tables 2 and 3 detail concurrent injuries and surgeries for each of the two patient groups at the time of the index surgery. Overall, failure occurred before to the end follow-up in 4 of 38 patients (10.52%) in the AIG and 13 of 42 patients (30.95%) in the CTTG (P= 0.300). Table 4 provides information on complication and reoperation rates.

Table 1: Study Cohorts' Demographic Overview

Variables	**CTTG (n=42)**	**AIG (n=38)**	**P Vaue**
Age in years (mean ± SD)	20.2 ± 6.9	24.7 ± 10.3	0.008
Mean BMI	24.2	24.2	0.838
Preinjury Tegner score, mean (range)	7.0 (5-9)	6.6 (4-8)	0.56
Laterality, % right-sided	57.3	51.2	0.489
Time interval, median (range), between injury and reconstruction	2.0 (0.5-34.6)	2.3 (0.26-180.3)	0.263
Duration of follow-up for patient-reported outcomes, months, median (range)	25.8 (23.9-74.5)	30.1 (24.7-72.9)	0.713
Clinical follow-up duration, months, median (range)	24.6 (1.5-61.5)	23.9 (0.7-59.9)	0.122

Table 2: Incidence of Injuries in AIG vs. CTTG

Variables	**AIG (n=38)**	**CTTG (n=42)**	**P Vaue**
Medial meniscal injury	14 (36.84)	12 (28.57)	0.598
Lateral meniscal injury	12 (31.57)	10 (23.80)	0.045
Chondromalacia/chondral defect	7 (18.42)	6 (14.2)	0.394
Medial collateral ligament sprain	2 (5.26)	5 (11.90)	0.264
None	3 (7.89)	9 (21.42)	0.115

Table 3: Incidence of Surgeries in AIG vs CTTG

Variables	**AIG (n=38)**	**CTTG (n=42)**	**P Vaue**
Meniscal Repair/Meniscectomy	21 (55.26)	19 (45.23)	0.089
Chondral defect repair/ chondroplasty	10 (26.31)	8 (19.04)	0.478
None	7 (18.42)	15 (35.71)	0.245

Table 4: Complications, Reoperations, and Failures Comparison Between All-Inside and Complete Tibial Tunnel ACLR Groups

Adverse Events, Subsequent Surgeries and Unsuccessful Outcomes	AIG (n=38)	CTTG (n=42)	P Vaue
None	27 (71.05)	31 (73.80)	0.530
Reoperation was necessary due to infection	1 (2.63)	0	0.999
Reoperation was necessary due to Arthrofibrosis	2 (5.26)	1 (2.38)	0.999
Revision meniscal surgery	3 (7.89)	2 (4.76)	0.989
Revision ACLR (failure)	4 (10.52)	13 (30.95)	0.200

PRO ratings are shown in Table 5. Between the two patient groups, there was no statistically significant difference in Lysholm or IKDC scores; however, at the most recent follow-up, patients in the CTTG required greater Tegner scores (P=0.042). Moreover, no statistically significant correlation was seen between the graft architecture, graft diameter, or fixation method and postoperative outcomes. The AIG took an average of 11.5 months to return to sport, whereas the group with a CTTG took 9.9 months (P=0.038). The complete patient group's graft diameter was divided into two size brackets: >9 mm and 9 mm. Failure rates were 11.43% in patients whose graft diameter was more than 9 mm and 15.15% in patients whose diameter was 9 mm. There was no discernible difference in the failure rate between the two graft sizes, according to the Fisher exact test (P = 0.616). In the AIG, the mean time to failure was 12.58 ± 5.56 months, whereas in the CTTG, it was 21.44 ± 12.86 months. A survival graph that contrasts with the duration of failure is shown in Figure 1.

Table 5: Comparison of Scoring Systems Between All-Inside and Complete Tibial Tunnel ACLR Groups

Variables	AIG (n=38)	CTTG Group (n=42)	P Vaue
Lysholm score	92.6	90.8	0.593
IKDC score	92.7	89.2	0.387
Tegner activity score	6.3	5.7	0.042

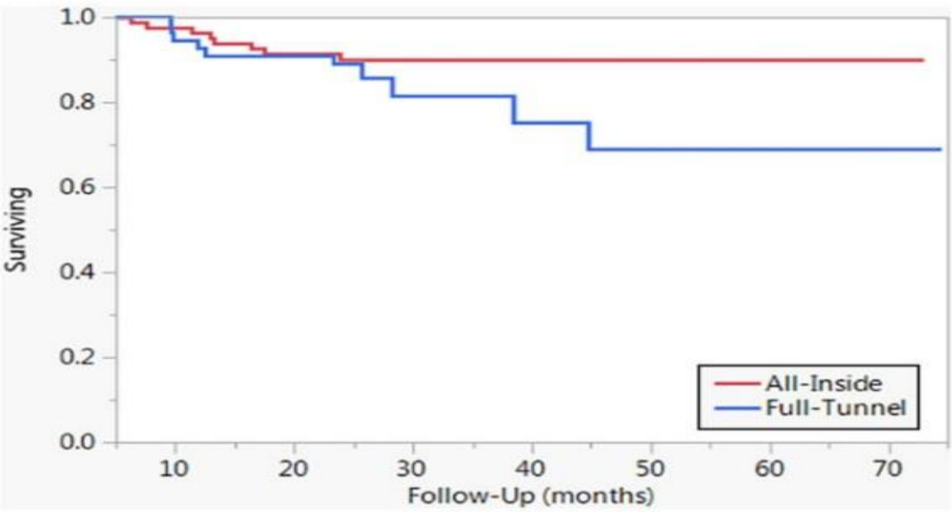

Figure 1: According to the survival plot, patients in the AIG had a mean time to failure of 12.58 ± 5.56 months, whereas those in the CTTG had a longer mean time to failure (21.44 ± 12.86 months). The failure rate was greater in the group with the CTT, although it was not statistically significant.

Discussion

This research compares a large number of patients who had ACLR in the same time frame (January 2021 and July 2023) using either a CTT approach or an AIT of hamstring autograft. Our 80-patient cohort is the biggest of several studies that compare these methods to date. According to the data, both the AI and CTT ACLR methods successfully restored knee ligamentous integrity and produced favorable PROs, high rates of return to sport, and generally similar outcomes. Moreover, the AI technique shown a lower failure rate.

Both groups of participants were able to resume activities close to their pre-injury phases, which were primarily non-competitive leisure or sports levels (13, 14). The mean postoperative Tegner score in the AIG was 6.3 (preinjury score, 6.6), and in the CTTG it was 5.7 (preinjury score, 7.0) (P=0.042). The greater Tegner scores found by the AIG achieved statistical significance because to the near similarity in mean scores between the two groups; nonetheless, this finding is most likely not clinically significant. The AIG mean postoperative IKDC scores were 92.7 and the CTTG mean scores were 89.2 (P=0.387). These findings demonstrated that following surgery, individuals from both groups had fewer or no symptoms and no or few limitations in everyday or sporting activities. The AIG mean postoperative Lysholm scores were 92.6 and the CTTG mean scores were 90.8 (P=0.593), indicating a very high degree of knee performance (18). The results of this investigation align with those of other studies (15–17).

In the present research, graft failure necessitated revision surgery before the end follow-up in 4 (10.52%) patients and 13 (30.95%) patients in the AIG and CTTG respectively. It is noteworthy that none of the surgeons who contributed individually to this research were linked to the greater failure rate. The literature reports all-inside ACLR failure rates ranging from 4.9% to 12.7% (18–20). Furthermore, in the present investigation, the whole tibial tunnel group had a substantially lower graft diameter and a much shorter return-to-sport delay. But because graft failure occurred in all cases with tibial tunnel syndrome at a mean of 21.44 months after surgery, it doesn't appear plausible that a prior return to sports had a role.

Conclusion

In summary, the research compared two groups, the All Inside Technique (AIG) and the Complete Tibial Tunnel Group (CTTG), in terms of baseline characteristics, injuries, surgeries, and complications. Patient-Reported Outcomes (PRO) at the most common follow-up intervals showed no significant differences in IKDC and Lysholm scores between the two groups, while the Tegner activity score was slightly higher in AIG. Importantly, the AIG group exhibited a lower failure rate and a slightly longer return to sport duration than the CTTG. These findings suggest that the AIG may offer advantages in ACL reconstruction, emphasizing its potential as a viable surgical approach.

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