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Comparative Study between Clinical Outcomes of All-Inside Technique and Standard Antero-Medial Technique in Anterior Cruciate Ligament Reconstruction

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ABSTRACT

Background: Although theoretically superior to traditional technique, anatomical single bundle ACLR via all-inside technique does not appear to demonstrate statistically significant advantages over conventional technique, as with the Lysholm scoring system.
Aim of the study: This study compared the post-operative clinical outcomes of arthroscopic ACL restoration using the "all-inside approach" versus the "traditional procedure".
Patients and Methods: Between March 2020 and December 2021, fifty patients were admitted to the department of Orthopedic surgery and Traumatology in Sayed Galal University Hospital with torn ACL exhibiting high grade pivot shift (II or III) under anesthesia.
Result: The mean age of the patients was (28.55 ± 8.57) years in group I and (28.75 ± 7.71) in group II. The mean duration of symptoms was (8.95 ± 6.09) months in group I and (10.28 ± 10.42) months in group II. The overall results at the sixth months were considered as excellent in Group I had five cases (33.33%) with excellent results and four cases (26.67 %) with good results. In group II, nine cases were excellent (60%) and three cases (20%) were good. In the 6th months, Group I mean was (85.50 ± 11.10) and group II was (91.90 ± 8.94) which was statiscally insignificant.
Conclusion: Anteroposterior and rotational kinematic control are not significantly provided by the all-inside approach. It is more expensive and technically difficult, though. When doing this operation on noncompetitive knees, this should be taken into account.

Keywords: *All Inside Technique; Standard Antero-Medial Technique; Anterior Cruciate Ligament Reconstruction.*

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INTRODUCTION

Meniscal or cartilage damage is more likely to occur in ACL tears (ACLt). Additionally, persistent instability might cause early osteoarthritis. [1]

The ability to resume playing quickly after ACLR is, for many patients, the primary evidence of a successful procedure. One of the following methods could lead to an ACL tear: Valgus trauma is an anteriorly directed force that affects an extended knee; it can also happen after excessive internal tibial rotation (IR) and hyperextension. [2]

Direct trauma, as seen in football, may cause this mode of injury. 65 percent of ACL injuries are "noncontact" injuries. This typically occurs when the player pivots (twists his knee), or stops abruptly. [3]

The number of active instances that are affected and the complications of injury all contribute to the significance of the ACL. It is crucial to understand that it does not cure on its own, necessitating reconstruction. [3]

The trans-tibial, anatomical accessory antero-medial (AAM) portal, and all-inside approaches are the arthroscopic ACLR procedures most often used today. [1, 4]

In ACLR, the method most frequently utilised to arthroscopically drill the femoral tunnel was trans-tibial drilling. [2] However, due to this technique's inclination of the femoral socket being influenced by the tibial tunnel, which results in a vertical femoral tunnel, its use is currently very limited. Even though the initial results were positive, the non-anatomical

graft site led to pain and early onset arthritis. [2, 3] This resulted in the knee's typical kinetics being disturbed. [5, 6] The inter-condylar and bifurcate ridges are also difficult to see in the lateral portal arthroscopic image. This could result in the graft being placed anteriorly or at a higher level than anticipated. [7]

"Anatomic" or "footprint" ACLR has achieved because it restores the graft's anatomical position, which also restores the knee's biomechanics [8].

To prepare the femoral tunnel with this approach, an AAM portal is necessary for simultaneous medial visualisation [4, 9]. However, instrument crowding and hyperflexion highlighted the method's extreme problems [10]. The femoral and tibial tunnels are independently hand-drilled [11]. Finding the medial surface of the LFC is crucial for defining tunnel placement [10].

The gracilis tendon, a secondary stabiliser for potential use as a graft in the future, is spared by the all-inside method. Reduced discomfort and the preservation of bone on the tibial side without periosteal violation are two additional benefits [1].

The aim of this study compared the post-operative clinical outcomes of arthroscopic ACL restoration using the "all-inside approach" versus the "traditional procedure."

PATIENTS AND METHODS

Trial design:

This study was a prospective randomized trial. The trial was a superiority RCT with parallel assignment interventional model.

Responsible party:

The study was conducted in El-Sayed Galal University Hospital, Department of Orthopedic Surgery and Traumatology, Faculty of Medicine, Al-Azhar University.

Sample size, Power, Effect size:

The sample size was determined using the statistical programme MedCalc and data from an earlier study. The study involved detailed analysis. Only a sample size of 30 patients with 15 patients in each arm was done.

Participants:

Of fifty patients assessed for eligibility, only 30 patients were enrolled in the study with torn (ACL) with grade II or III pivot shift test under anesthesia. (Appendix G)

Patient recruitment:

Patient recruitment into the study began on March 2020. Target sample size was reached on December 2021.

Intervention:

Patients were classified into two parallel groups. Fifteen patients were assigned to conventional single bundle ACLR (Control). The other fifteen patients were assigned all-inside ACLR. (Experimental). The two groups were matched for gender, age, and duration of follow up.

Outcomes:

Primary outcome: improvement in Lysholm score.

Inclusion criteria:

Patients with positive Lachman test regardless its grade, positive pivot shift test and finally the diagnosis had been confirmed by MRI of the involved knee.

Exclusion criteria:

Patients <18 or >60 years old, patients with no or mild anterolateral instability, revision ACLR, patients with other or multi-ligamentous knee instability, partial ACL rupture (detected by MRI), patients with recent contralateral ACLR as it affects the LKS, established osteoarthritis (Kellgren-Lawrence grade 3 or 4) identified on standing knee X-rays, more than 50% of the medial or lateral meniscus removed during procedure as it affects the LKS, any previous surgery to the knee.

Randomization:

Using Random Allocation Software™, a computer-generated randomization list was created (Appendix A). Simple randomization was the method used.

Allocation concealment:

The list was examined in the operating room, and the anticipated treatment plan was implemented following the pivot shift test under anesthesia that confirmed high degree anterolateral instability.

Blinding:

The study participants were blinded. (Single blinded study)

Follow up period:

All cases were followed up for 2, 4 weeks, 12 weeks and 6 months, clinically for functional status using the Lysholm Knee Score.

METHODS

Methods of examination:

History: personal history: Name, age, sex, occupation, address and sport activity, side affected, history of the present illness: pain, swelling, giving way, stiffness, locking, date and mechanism of injury, past medical and surgical history, habits: Smoking, work.

Clinical Examination goes through following steps: Gait and posture: varus, recurvatum…. etc, inspection and Palpation: medial joint pain, Quadriceps wasting, movement: Range of motion, active then passive, effusion, patellofemoral joint: Crepitus, patellar grind test, meniscal Examination: Joint line tenderness, McMurrey test started with the contralateral limb first, instability tests: started with the contralateral limb first.

Lab: routine laboratory tests for surgical preparation.

Radiological evaluation: standing AP and lateral X-rays of the affected knee, MRI of the affected knee.

Methods of treatment:

Under spinal anaesthetic, patients were all operated on while lying flat. During the arthroscopic

evaluation of the medial compartment, a post was placed at the operating table's edge to support the thigh while allowing valgus movement.

Fig. 1: Positioning of the patient in supine position with high tourniquet application.

Diagnostic knee arthroscopy:

Following the application of a high tourniquet, the table's edge was prepared just above the knee joint to maintain the patient's free movement. Diagnostic Knee arthroscopy was done using the standard anterolateral and AM portals. We started by treating any intra-articular co-morbidities. A partial arthroscopic menisectomy was used to treat meniscal lesions.

Graft Harvest:

In group I both ipsilateral Gracilis and Semitendinosus autograft were harvested for anatomic single bundle ACL reconstruction. **In Group II**: only Semitendinosus autograft was harvested.

Fig. 2: Graft harvest for ACLR.

Graft preparation:

On the graft table, an assistant prepared the graft. There were no remaining muscle fibres or connections.

For Group I:

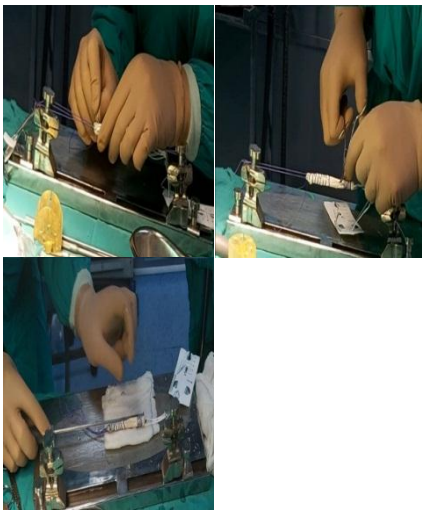

Fig. 3: Suturing the tibial sided part (whip stitches) done through both tendons then as a one unit. For a length of the whole tibial tunnel then Suturing of the femoral sided part after measuring the whole trans osseous femoral portion then the tibial sided part all whip stitched with six suture ends, whereas the shorter suspensory femoral loop fixed to an end button and adjusted thereafter.

For Group II: High-strength sutures (Fiber Wire, Arthrex) secured the graft in a loop.

Fig. 4: Measuring the length and diameter of the graft.

Femoral Socket Creation and graft fixation (common in both groups):

Fig. 5: Arthroscopic view showing ACL graft at the end of the operation and x-ray shows an All-Inside, GraftLink, Double-Tight-Rope ACLR technique.

Postoperative protocol:

Patients got intravenous antibiotics, cryotherapy (using ice packs), anti-edematous modalities, anticoagulation, and started static quadriceps workouts while they were hospitalised for one or two nights. Following surgery, knee flexion of up to 90 degrees was encouraged. Knee extension to a zero degree was permitted right away. Two crutches were used for balancing and full weight bearing was permitted. The suction drain (Redivac) was removed after 1-2 days. Patients were discharged on oral antibiotics analgesics for one week. Oral or injection anti-coagulation prescribed for prevention of DVT prophylaxis was prescribed for both groups for two weeks. After two weeks, one crutch was discarded and at one-month post-operative, weight bearing was allowed without crutches. Sutures were removed after 2 weeks. Physiotherapy was started, following the rehabilitation program for 6 months. All patients followed an identical postoperative rehabilitation protocol created by the Fowler Kennedy Sports Medicine Clinic Physical Therapy Department and Focus was placed on early range of motion and weight bearing as follows:

Method of assessment of the results:

Patients were assessed postoperatively and during the follow up visits subjectively through a questionnaire. The outcome of the study was the LKS at the 4th, 12th weeks and at the 6th months.

Patient Reported Outcome Measures (PROMs):

Patients were assessed using one main sports related PROM scores. The LKS. The LKS is an eight-item patient reported scale that evaluates knee symptoms such as limp, locking, swelling, instability, pain, stair climbing, and squatting. It is one of the most commonly used clinical scores for knee evaluation, introduced in 1982. The LKS is graded as Excellent (95–100), Good (84–94), Fair (65–83), or Poor (<65). The questionnaire was done by us at Sayed Galal University Hospital. This survey has been translated into Arabic. Patients who missed their follow-up appointment were called and requested to show up so they may receive credit for attending. In our study, the results were used to compare Group I with Group II.

Method of statistical analysis:

Data were fed to the computer and analyzed using IBM SPSS software package version 20.0. (Armonk, NY: IBM Corp) Qualitative data were described using number and percent. The Kolmogorov-Smirnov test was used to verify the normality of distribution Quantitative data were described using range (minimum and maximum), mean, standard deviation, median and interquartile range (IQR). Significance of the obtained results was judged at the (0.05) p of value.

RESULTS

Lysholm	Group I (n = 15)	Group II (n = 15)	T	P
4 weeks				
Min. – Max.	16.0 – 77.0	30.0 – 91.0		
Mean ± SD.	51.50 ± 19.19	59.75 ± 16.74	1.254	0.219
Median	52.0(39.0 – 67.50)	61.0(50.50 – 72.0)		
3 months				
Min. – Max.	60.0 – 99.0	60.0 – 99.0		
Mean ± SD.	80.10 ± 11.49	86.65 ± 9.14	1.727	0.095
Median	81.50(71.0 – 90.0)	90.0(81.0 – 93.50)		
6 months				
Min. – Max.	62.0 – 100.0	66.0 – 100.0		
Mean ± SD.	85.50 ± 11.10	91.90 ± 8.94	1.739	0.093
Median	85.50(74.0 – 95.0)	95.0(85.0 – 99.0)		

t: Student t-test p: p value for comparing between the studied groups; Group I: Conventional, Group II: All inside

Table 1: Comparison between the two studied groups according to postoperative Lysholm score

Lysholm	Group I (n = 15)		Group II (n = 15)		χ^2	p
	No.	%	No.	%		
4 weeks						
Excellent (95 – 100)	0	0.0	0	0.0	1.832	$^{MC}p=$ 1.000
Good (84 – 94)	0	0.0	2	13.33		
Fair (65 – 83)	5	33.33	5	33.33		
Poor (<65)	10	66.67	8	53.33		
3 months						
Excellent (95 – 100)	2	13.33	4	26.67	2.257	$^{MC}p=$ 1.000
Good (84 – 94)	4	26.67	5	33.33		
Fair (65 – 83)	7	46.67	5	33.33		
Poor (<65)	2	13.33	1	6.67		
6 months						
Excellent (95 – 100)	5	33.33	9	60.0	3.168	$^{MC}p=$ 1.000
Good (84 – 94)	4	26.67	3	20.0		
Fair (65 – 83)	5	33.33	3	20.0		
Poor (<65)	1	6.67	0	0.0		

Table 2: Comparison between the two studied groups according to postoperative Lysholm score after making categories

Regarding complications, there was no significant difference between both groups regarding overall incidence of complications.

Complication	Group I	Group II
ACL failure	One	One
Superfacial infection	Nil	One
Deep infection	Nil	Nil
Heamarthrosis	Two	One
Superfacial heamatoma	Two	One
Thromboembolism	One	One
Wound dehiscence	Two	Nil
Total	Eight	Five

** Statistically significant difference (p < 0.05); X2 Chi square value, rho: Spearman coefficient.*

Table 3: Comparison between the two studied groups according to complications

Cases

Case 1:

Male patient 35 years old complaining of pain and swelling at Rt. knee, instability at Rt. knee joint (giving away), inability to walk (limping gait), Locked knee.

Mode of trauma:

Noncontact injury as a result of twisting of his right knee joint one month ago.

Examination:

+ve lachman test, +ve anterior drawer test.

Investigations:

Plain x-ray: Standing AP and lateral X-rays of the affected knee looks Normal x-ray. **MRI:** We can't visualize ACL fibers as a result of ACL rupture.

Fig. 6: MRI showing complete tear at ACL

There is a complete tear at the ACL fibres, as determined by the patient history, clinical examination, and MRI results.

Fig. 7: Post-operative x-ray for ACL reconstruction with All-Inside technique

The femoral and tibial end buttons are visible on the post-operative x-ray for an all-inside ACL restoration. After receiving oral antibiotics and analgesics for a week, patients were discharged. Anticoagulation was provided either orally or intravenously to avoid DVT. Sutures were removed after 2 weeks and physiotherapy was started, following the rehabilitation program (**Fowler Kennedy Sports Medicine program)** for 6 months. (**photos below**)

Fig. 8: Follow up

Case 2:

Male patient 25 years old complaining of pain at left knee joint, edema, giving away knee, walking in crutches.

Mode of trauma:

Direct trauma to his knee during playing football 2 weeks ago.

Examination:

+ve lachman test, +ve anterior drawer test.

Investigations:

Plain x-ray: Standing AP and lateral X-rays of the affected knee looks Normal x-ray. **MRI:** We found disruption at ACL fibers of the affected knee joint.

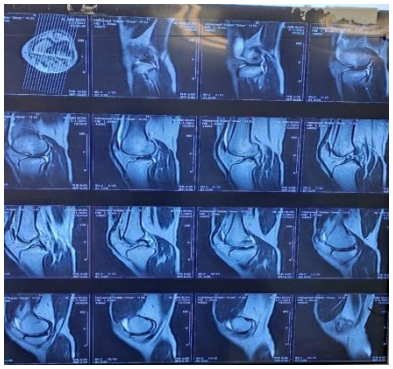

Fig. 9: MRI showing complete tear at ACL

There is a complete tear at the ACL fibres, as determined by the patient's medical history, clinical examination, and MRI results.

Fig. 10: Post-operative x-ray for ACL reconstruction with AM technique

Only the femoral end button is visible on the post-operative x-ray following trans-tibial ACL restoration. After receiving oral antibiotics and analgesics for a week, patients were discharged. Anticoagulation was provided either orally or intravenously to avoid DVT. Sutures were removed after 2 weeks and physiotherapy was started, following the rehabilitation program (**Fowler Kennedy Sports Medicine program)** for 6 months. (**Photos below**)

Fig. 11: Follow up

Case 3:

Male patient 36 years old complaining of pain and mild edema at Rt. knee, instability at Rt. knee joint (giving away), limping gait, locked knee.

Mode of trauma:

Twisting of his right knee joint 2 months ago.

Examination:

+ve lachman test, +ve anterior drawer test.

Investigations:

Plain x-ray: Standing AP and lateral X-rays of the affected knee looks Normal x-ray. **MRI:** We found disruption at ACL fibers of the affected knee joint.

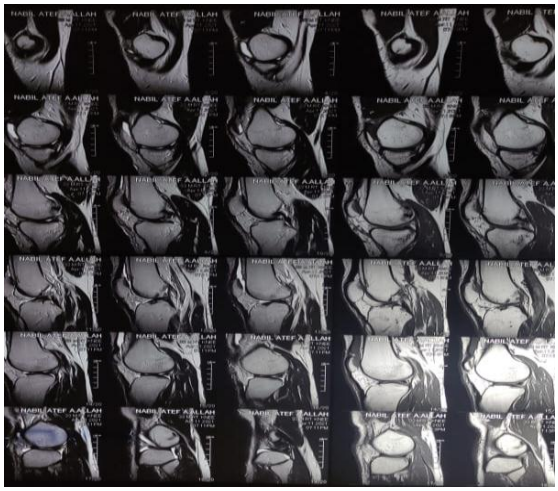

Fig. 12: MRI showing complete tear at ACL

Treatment:

This patient was prepared for ACL reconstruction by all-inside technique.

Follow up:

Patients stayed in the hospital for one or two nights, received some medications, did post-operative x-ray and start static quadriceps exercise.

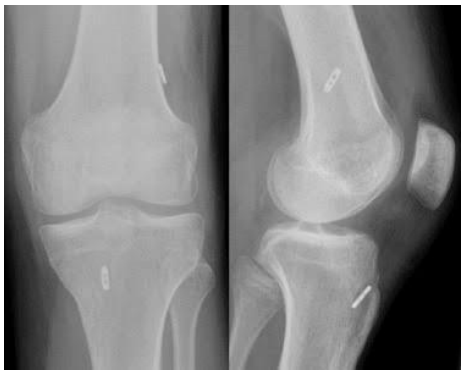

Fig. 13: Post-operative x-ray for ACL reconstruction with All-Inside technique

The femoral and tibial end buttons are visible on the post-operative x-ray for an all-inside ACL restoration. After receiving oral antibiotics and analgesics for a week, patients were discharged. Anticoagulation was provided either orally or intravenously to avoid DVT. Sutures were removed after 2 weeks and physiotherapy was started, following the rehabilitation program (**Fowler Kennedy Sports Medicine program)** for 6 months. (**photos below**)

Fig. 14: Follow up

Case 4:

Male patient 25 years old complaining of pain at Rt. knee joint, edema, giving away knee, walking in crutches.

Mode of trauma:

Twisting at his knee during playing football one weeks ago.

Examination:

+ve lachman test, +ve anterior drawer test.

Investigations:

Plain x-ray: Standing AP and lateral X-rays of the affected knee looks Normal x-ray. **MRI:** It shows loss of normal contour and pattern of the ACL.

Fig. 15: MRI showing complete tear at ACL

Fig. 16: Post-operative x-ray for ACL reconstruction with AM technique

Only the femoral end button is visible on the post-operative x-ray following trans-tibial ACL restoration. After receiving oral antibiotics and analgesics for a week, patients were discharged. Anticoagulation was provided either orally or intravenously to avoid DVT. Sutures were removed after 2 weeks and physiotherapy was started, following the rehabilitation program (**Fowler Kennedy Sports Medicine program)** for 6 months. (**Photos below**)

Fig. 17: Follow up

DISCUSSION

The ACL serves as a barrier against anterior tibial rotation and translation with respect to the femur. This phenomenon has been identified in cases of damaged ACLs, which led to a considerable increase in AP knee laxity, which peaked at full extension. Reconstruction is the primary form of treatment for

ACLt since other methods could not produce good outcomes in young people. [12]

Our study contrasts the standard procedure, which uses a single femoral sided end button with biodegradable IFS on the tibial side, with the all-inside technique, which uses TightRope and double-sided inserted end buttons from Arthrex using the GraftLink technique.

Lubowitz et al. [14] discovered that all-inside approach led to statistically insignificant clinical results measured by LKS, IKDC score, KSS, SF-12 score, and narcotic use but decreased post-operative discomfort as determined by VAS scoring system. When compared to the baseline, the VAS pain score for the all-inside approach was significantly reduced on the first day, the seventh day, the tenth day, and two years afterwards.

Gobbi et al. [15] conducted a follow up (FU) for 97 patients who had done reconstruction using either a ST autograft alone (50 patients) and (ST+GT) autograft together (47 patients). International Knee Documentation Committee (IKDC), Noyes, Lysholm, Tegner), self-evaluation score (SANE) and objectively using computerised knee laxity analysis were used to compare the two groups. Additionally, they used the isokinetic flexion, extension, and IR-ER tests. According to all metrics, the results showed no significant difference between the 2 groups. The IR torque deficit was much greater in the (ST+GT) group, which was one of only two exceptions recorded. In the (ST+GT) group, they also discovered a greater external-to-IR ratio. Despite the lack of a clinical difference between the ST group and the (ST+GT) group, they came to the conclusion that more research was necessary to understand IR weakening caused by the removal of two tendons.

According to the findings of our study, there are no advantages to using the All-inside approach over the conventional one at the fourth week, third month, or sixth month.

After two years of follow-up, Kouloumentas et al. [16] likewise observed no statistically significant difference between patients treated with all-inside and those treated with conventional approach using the Lysholm grading system. This study compared the "all-inside technique" for ACLR, using a single, quadrupled semitendinosus tendon (4ST) autograft fixed with a femoral sided suspensory button and a tibial sided IFS applied through a full tunnel aperture, to the "conventional technique," using 2ST+2GT autograft fixed with a tibial sided IFS applied through a full tunnel aperture.

In six weeks, 12 weeks, and six months, Shantanu et al. [17] discovered a significant difference between the all-inside technique and the traditional technique using LKS. Antero-medial portal method was used to establish femoral sockets in the control (conventional) group, with the knee flexed 120–130 degrees. Using a cannulated drilling technique, the tibial tunnel was completely bored in an ante-grade (outside-in) manner. A bio-absorbable tibial IFS (Delta tapered screw; Arthrex) was used to maximise full-tunnel group fixation, and the tightrope RT loop (also from Arthrex) was utilised for femoral sided fixation. The "all inside" group had retrograde femoral tunnel drilling using a flip cutter to prepare the femoral socket, drilling only a specific quantity of the tunnel's bone. Flip cutters were also used to drill the retrograde tibial tube (Retro Drill; Arthrex). The femoral and tibial outer cortices were also spared by this method. On both sides, TightRope tension (Arthrex) was used to fixate the graft. [17]

At three, 12 and 24 months postoperatively, Brandsson et al. [13] observed no statistically significant difference in the Lysholm rating system. The femoral tunnel was made using the tibial tunnel, and both sides were secured with interference screws. This method was completely different from the one used today. The use of PT bone transplant was another distinction.

CONCLUSION

In patients with complete ACLT, there is no difference in LKS between all-inside ACLR and conventional technique over the first six months. In terms of functional outcomes and quick return to sports in recreational athletes, all-inside ACLR is comparable to standard ACLR.

Conflict of interest : none

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