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## All-inside technique versus conventional Transportal anterior cruciate ligament reconstruction: A retrospective study

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### Abstract

Anterior cruciate ligament (ACL) tear is one of the most common sports injuries. Surgical reconstruction is the most commonly used treatment after high grade ACL injuries. With the recent advances in the field of sports medicine, the all-inside technique, is reported to have less postoperative pain as compared to the conventional transportal procedure. Functional results such as range of motion or ligament laxity obtained after both techniques have not been assessed. We have retrospectively compared the outcome after All-Inside Technique and Conventional Transportal technique in patients who have partial or complete ACL tear on the basis of post-operative range of motion, pain and subjective functional results.

**Keywords:** Anterior cruciate ligament, all-inside, transportal, ligament laxity

### Introduction

ACL injuries are one of the most common sports injuries with an estimated incidence as high as of 400,000 patients each year in the United States (in comparison with 120,000 patients undergoing hip replacement surgery) <sup>[1]</sup>. Many techniques have been designed to treat the ACL-injured knee. However, even the gold standard techniques, have failed to prevent the premature onset of arthritis for patients with ACL injuries <sup>[2]</sup>. ACL reconstruction procedure started in early 80's and has evolved over the years. Conventional transportal ACL reconstruction is a method that has been followed for a quite time now whereas All-inside technique is a newer technique with the use of retrograde drilling instrument called as flip-cutter. All-inside technique presents three main features: 1) it uses sockets instead of full-tunnels to insert the graft. 2) the sockets are created independently using retrograde-drilling pins or Flip Cutter and both femoral and tibial sockets are performed in an inside-out direction (from knee joint to bone). 3) this technique uses cortical endobuttons as suspensory fixation devices that allow the tensioning of the graft even when it is already fixed <sup>[3]</sup>. However, All-inside techniques requires higher expertise as compared to conventional transportal technique.

### Objectives

Objectives of the present study was to compare the All-Inside Technique with Conventional Transportal ACL reconstruction in cases of ACL injuries and assess the functional outcome in patients admitted to Ims And Sum Hospital, Bhubaneswar from- July 2017 to June 2019 in terms of pain, knee's range of motion, subjective functional results using Lysholm scoring system.

### Methodology

It was a retrospective study conducted at IMS AND SUM hospital, Bhubaneswar during the period of July 2017 to June 2019. 78 patients aged between 18-50 years with partial or complete ACL tear that was associated with or without meniscal tears were treated at IMS and SUM hospital, Bhubaneswar. In 42 patients All inside ACL reconstruction was done and conventional transportal ACL reconstruction was done in 36 patients. Both groups were similar in all criteria. All patients who had associated injuries of medial collateral ligament, posterior cruciate ligament, lateral collateral ligament or posterolateral corner injury, multiple

co-morbidities, ACL injuries associated with fractures, radiologically documented knee osteoarthritis, unwilling patients were excluded from study. We have analysed all initial AP, Lateral radiographs and available MRI scans. We reviewed these patients charts retrospectively. Patient's pre-operative history and medications were documented. AP and lateral radiographic examination at the time of injury, after surgery and at the time of last follow-up were available for all patients. Subjective functional results using Lysholm scoring and VAS scores were performed at the last follow-up or at the time of a complication. No apparent differences between the two groups regarding group size, age, sex or co-morbidities were recorded. At minimum follow-up of 1, 3, 9 months lysholm and VAS scores were calculated. Results with complications were analysed in both the groups and there were no significant differences between the two groups as regards lysholm scores.

**Surgical procedures:** Patients were randomized to either All-inside or conventional transportal technique groups. All-inside ACL reconstruction was done in 42 patients with the patient in supine position and knees flexed (90 degrees) with a side-support stand on a radiolucent table. First diagnostic arthroscopy was done and ACL tear was confirmed. Ipsilateral semitendinosus graft was harvested with the help of

stripper. The graft is linked with tight Rope sutures, and prepared in a graft Station to obtain a four-stranded graft of length 70mm and diameter 8mm. An exact graft length is important as the femoral and tibial socket lengths are predetermined, each measuring 25mm and the intraarticular graft length measures 20mm. Footprints of the injured ACL was identified and the remaining fibres are debrided leaving behind some Fibers. A femoral jig is fixed in the femoral footprint of the ACL and a guide pin is inserted in the femoral bone, advancing until the joint. Then, pressing a button, the guide pin becomes a retrograde drill or flip cutter (with a diameter of 8mm) the femoral socket is created leaving behind a 25-mm femoral socket with a thin cortical bone-bridge. Pulling sutures are passed from the femoral socket until the anteromedial portal. Same steps were followed to create the tibial socket. After the creation of both sockets, both the Tight Rope sutures were assembled and the pulling sutures in the endo button, was used to pull the graft from the anteromedial portal until the femoral socket. When the button reaches the external surface of the femur it is flipped and with the Tight Rope suture graft was tensioned to totally fill the socket. The same steps were followed for the tibial fixation. Position of the endo buttons was confirmed by fluoroscopic guidance. Wound closure was done and No. 12 suction drain was placed in situ.



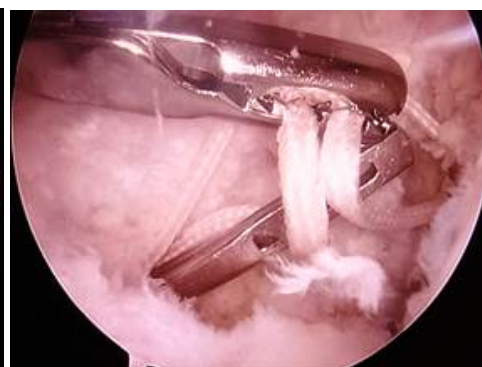
Patient positioning



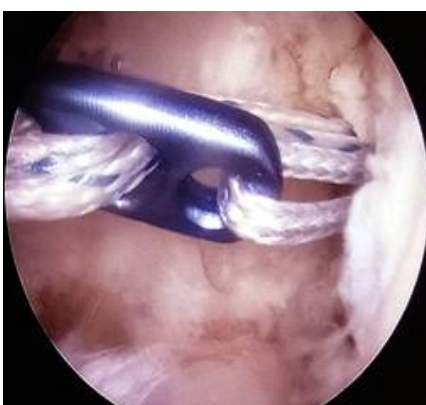
Graft preparation



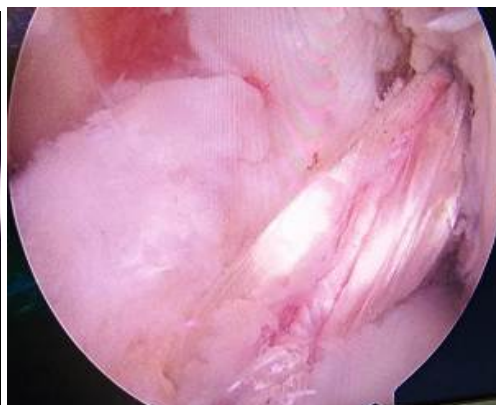
Tibial socket preparation



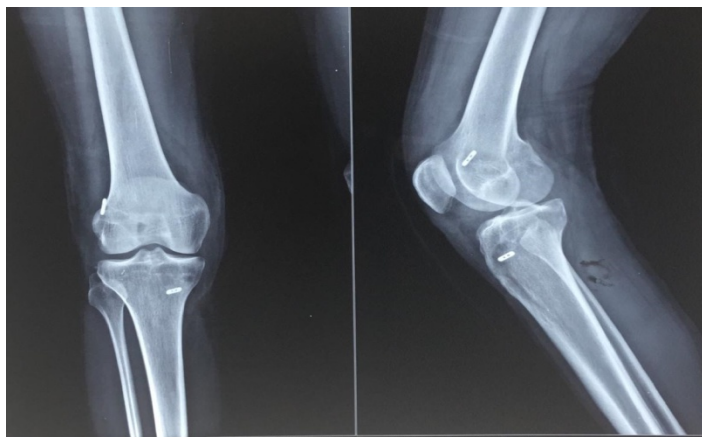
Retrieval of femoral and tibial loops



Graft pulled by the pulling suture



final graft position



**Fig 1-7:** X-ray in lags

**Fluoroscopy confirming endobutton position**

For the conventional trans portal group which included 36 patients, were also placed on the radiolucent table and with the knee in 90 degrees flexed position. Diagnostic arthroscopy was done and ACL tear was diagnosed. Graft was harvested from semitendinosus or gracilis (same way as that of all-inside technique) with the help of stripper. Similar to all-inside technique, ACL Footprint was identified and femoral & tibial jig were placed. Full length femoral and tibial tunnels were made. Graft was passed through the tunnels and locked into place with femoral endobutton and tibial bioscrew. Bio screw was tightened enough and new ligament was tested for the laxity. Position of the implant was confirmed by fluoroscopic guidance. Wound was closed over a No.12 suction drain. All the surgical procedures were performed by the same qualified surgeon. Patient was given 3rd generation cephalosporin pre- and post-operatively (for 72 hours).

**Immediate post-operative period upto 4 weeks:** Passive, active assisted and active knee flexion and full weight bearing was allowed with knee brace after 48 hours of operation. Static quadriceps exercise were promoted all throughout the day with minimum 6 times a day for 5 mins each. Squatting was not allowed during the 1<sup>st</sup> month.

**Period 4weeks- 16 weeks:** Patient was asked to wear the knee brace all throughout the day and was allowed to open it at night upto 12 weeks after which regular use of knee brace was discontinued. Active knee flexion and squatting with support were allowed 4-6 times a day. The patient was asked to perform active graded quadriceps exercise. Cycling was promoted from 12<sup>th</sup> week onwards. Period 16 weeks-36 weeks-Squatting without support was allowed from 24<sup>th</sup> week onwards. Patient was promoted to continue active graded quadriceps exercise with further increase in the level of difficulty. Jogging with steps less than 1meters were promoted from 16<sup>th</sup> week onwards. After 24 weeks steps >1mtrs and less than 2 meters were allowed.

Track and field events were allowed from 24<sup>th</sup> week onwards. (with special avoidance of long and high jumps).Patient was asked to wear the knee brace at places where a fall might result upto 24<sup>th</sup> week.

Beyond 6 months Jogging on uneven ground was allowed. Contact sports were allowed. Patient was promoted training of all degrees to gain the pre injury activity level.

**Data analysis:** All the data were compiled in a tabulated manner. The flexion deficit at each follow up visit was calculated by subtracting the flexion ROM from the pre-operative normal knee flexion value obtained at the time of admission for operation. A professional statistics analysis software “SPSS21” was used to analyse the data and calculate the Mean/median /variance/standard deviation ect as per the requirement and nature of the data. The provision for exclusion of missing data during calculations present in the software were used. Test of significance: The Mann Whitney U test was used for continuous and non continuous variables. The Wilcoxon signed rank t test was used for comparison of pre and post operative values within a group. Initially “the test for equality of variance was done to assess the correct version of independent t test to be used for the result. In cases where the P value for equality of variance was >0.05 the equal variance t-test was used as a test for significance. The lachman and pivot shift results were collected in form of ordinal values so the further calculation of the proportion of the cases was done and proportional test of significance was used for calculation of P value. The extension lag and flexion deficit were in the ratio scale so independent group t –test and two sample t test were used for calculation of the p value. For all calculations the confidence limit was set to 95% and p value <0.05 were considered significant.

**Result analysis**

**Age:** In our study mean age is 24.84 years with range of 15-45 years and standard deviation of 6.78 years overall.

**Table 1:** Age

Overall			BPT Group			Semi T & Gracilis		
Mean	Median	Range	Mean	Median	Range	Mean	Median	Range
26.22	25	15-45	25.26	25	15-39	27.21	27	15-45

**Sex:** out of 78 patients 69 were males and 9 were females

**Mechanism of injury:** Road traffic accidents were by far the most common mode of injury (60patients: 76.92%) followed

by slips or falls during activities of daily living (9 patients 11.53%) followed by Sports injuries (8 patients 10.25%) and others (1 patients 1.28%)

**Table 2:** Injury operation interval in weeks

Overall		Conventional group		All-inside Group	
Mean	Range	Mean	Range	Mean	Range
15.3	3-96	18.66	6-81	12.4	9-96

**Table 3:** Preoperative lachman grade

Grade	Conventional Group (N=36)		All-Inside Group(N=42)		Test of significance P value
	Number	Percent	Number	Percent	
Grade 1	3	8.33	2	4.76	.828
Grade 2	18	50	22	52.38	.918
Grade 3	12	33.33	15	35.71	.465
Grade 4	3	8.33	3	7.14	.126

Both the group showed no significant difference in their Pre-operative Lachman grades. (The confidence limit of the statistical analysis was set to 95%. p value <0.05 was considered significant)

**Table 4:** follow up Lachman grades

Lachman grade	Conventional group		All-inside group		Test of significance (p value)
	Number	Percent	number	percent	
<b>First follow up:1 month (n=33 for Conventional and n=39 for All-inside groups)</b>					
Grade 1	33	100	39	100	No difference
Grade 2	0	0	0	0	
<b>2<sup>nd</sup> follow up 3months (n=33 for Conventional and n=39 for All-inside groups)</b>					
Grade 1	32	96.96	38	97.43	0.432
Grade 2	1	3.03	1	2.56	
<b>3<sup>rd</sup> follow up,9months (n=33 for Conventional and n=39 for All-inside groups)</b>					
Grade 1	32	96.96	38	97.43	0.432
Grade 2	1	3.03	1	2.56	

All patients in each group showed grade 1(,5mm) laxity at first follow up. At 2<sup>nd</sup> and 3<sup>rd</sup> follow up however 1 patient in conventional group (3.03%) and 1 in All-inside group

(2.56%) showed laxity corresponding to grade 2. These findings were not significant (p value-.432)

**Table 5:** Pivot shift test results of the two groups

Test result	Conventional group		All-inside group		Test of significance (P value)
	No	Percent	No	Percent	
<b>Pre operative: pivot shift test summary and analysis</b>					
Yes	33(n=36)	91.66	38(n=42)	90.47	0.164 (not significant)
No	3	8.33	4	9.52	
<b>First follow up(1month): pivot shift test summary and analysis</b>					
Yes	1(n=33)	3.03	1(n=39)	2.56	0.907(not significant)
No	32	96.96	38	97.43	
<b>Second follow up(3months): pivot shift test summary and analysis</b>					
Yes	1(n=33)	3.03	1(n=39)	2.56	0.907(not significant)
no	32	96.96	38	97.43	
<b>Third follow up(9months): pivot shift test summary and analysis</b>					
Yes	1(n=33)	3.03	1(n=39)	2.56	0.907(not significant)
no	32	96.96	38	97.43	

The pivot shift test results showed no significant difference between the two group at any follow up. Initially preoperative results showed that the two groups were standardised as far as there pre operative pivot shift results were concerned. At all the 3 follow up visits the results in both the groups were very

much comparable and did not even show a trend towards any group. Thus it can be concluded that as far as rotational control after ACL reconstruction is concerned both grafts are equally good for the purpose.

**Table 6:** Extension lag results of the two groups

Follow up	Conventional group				All-inside group				Test of significance (p value)
	n	mean	Standard deviation	Range	n	Mean	Standard deviation	Range	
1	33	12.69	5.73	5-25	39	10.25	4.47	5-20	0.022(sig)
2	33	1.75	2.28	0-5	39	1.64	1.95	0-5	0.117
3	33	1.28	2.14	0-5	39	1.21	1.54	0-5	0.132

At 1<sup>st</sup> follow up the conventional group showed significantly greater extension lag (p value 0.022). But at the 2<sup>nd</sup> and 3<sup>rd</sup> follow up both the groups showed no significant difference as far as the extension lag was considered. Thus it can be

concluded that most patients undergoing ACL reconstruction with conventional technique tend to gain up the quadriceps strenght loss due to surgery between 3<sup>rd</sup> and 9<sup>th</sup> months period. Before this they lag behind the All-inside group in

term of recovery of the extensor muscle power. Though the actual difference (mean and standard deviation) at each follow up are very narrow at each follow up and apparently it might appear that both the groups are very comparable at this parameter yet there is a clear evidence of early recovery of

knee extensor function in the All-inside group. Moreover extensor lag is a very sensitive indicator of quadriceps strength so this difference is to be kept in mind while making a choice.

**Table 7:** flexion deficit results of the two groups

Follow up	Conventional group				All-inside group				Test of significance (p value)
	n	mean	Range	Standard deviation	N	Mean	Range	Standard deviation	
1	33	24.16	5-55	18.45	39	13.38	5-50	11.87	0.001
2	33	4.85	0-15	5.64	39	3.25	0-15	5.56	0.956
3	33	3.182	0-15	5.34	39	3.03	0-15	5.25	0.905

The recovery of flexion deficit in the conventional group lagged behind significantly as compared to those in the All-inside group at the 1<sup>st</sup> follow up (p value 0.001). However by the end of 2<sup>nd</sup> and 3<sup>rd</sup> follow up though the mean deficit in both the groups were very similar (no significant difference: p

value-0.956, 0.905). Thus it can be said that flexion deficit recovery after using conventional technique is slower in the 1st month but tends to catch up with those of All-inside group between 3-9 months. At 3<sup>rd</sup> and 9<sup>th</sup> months the flexion deficit is similar in both groups.

**Table 8:** Comparing the Lysholm Score of the Two Groups

Time	Conventional group				All-inside group				Test for significance (p value)
	n	median	Range	SD	n	median	Range	SD	
Pre-operative	36	69	42-77	7.26	42	68	42-78	6.72	0.672
3 <sup>rd</sup> follow up	33	90	80-95	3.57	39	92	81-96	3.87	0.927

The pre operative score shows that the two groups were very much standardised (no significant difference p value 0.672). At 9 months follow up both group were found to be similar

with regards to this score.(p value 0.927). Thus it can be concluded that functional recovery of patients in both groups are similar by 9<sup>th</sup> month.

**Table 9:** Tenger activity scale

Time	Conventional group				All-inside group				Test of significance (p value)
	n	Median	Range	SD	n	Median	range	SD	
Pre-operative	36	2	2-4	0.90	42	2	2-5	1.05	0.947
At 9 months	33	6	5-8	0.88	39	7	6-8	0.81	0.09

Both the groups were similar before the operation (p value 0.947) and at 9 months follow up the median Tenger activity scale was 6 in the conventional group and 7 in the All-inside group (p value 0.09). Though there was a activity level difference of 1 scale yet this value did not attain significance. Maybe a greater number of subjects would have made this

finding a significant one. Since each grade on this activity scale encompasses far more difficulty level than what could be ascribed to the mere difference of one grade, this difference may be considered as a trend in absence of clear significant difference.

**Table 10:** (VAS 1: “Are you happy that you got yourself operated for your problems”? the answer to which were asked in affirmation or negation (yes/no)

response	Conventional group(n=33)		All-inside group(n=39)		Test of significance (p value)
	Number	Percent	number	percent	
Yes	30	90.9	36	92.1	0.87 (not significant)
No	3	9.1	3	7.9	

Thus both the groups showed no difference at the final follow up with regard to the VAS 1 question.

**Table 11:** (VAS 2: “how much on scale of 0- 100 would you rate this operation in fulfilling the expectations you had when you decided to get yourself operated?”)

Conventional group(n=33)		All-inside group(n=39)		Test of significance (p value)
Median	Range	Median	range	
82	25-100	84	25-100	0.789

The response to VAS 2 shows that the two group show no significant difference as far as the level of satisfaction with their respective operations is concerned.

**Discussion**

The all-inside technique is a relatively new technique described in 2011, so there is not much evidence about this

procedure [3]. There are very few clinical trials that compared this technique with the transtibial technique, reporting superiority of the all-inside technique as regards post operative pain [5, 6]. Another reported advantage of all-inside technique is that the socket drilling is performed independently over ACL footprints and resulting in a more anatomic position, with increased stability of the knee [4, 3, 7]. The adjustable loop graft suspension (with an endobutton), has been shown to be equivalent to other fixation methods as regards graft failure or loosening [11]. Another advantage of All-inside technique is that it only requires the harvesting of the semitendinosus, leaving behind the gracilis, which can be utilised for other ligament reconstruction, reducing morbidity associated with graft harvesting and improving lower limb's stability [6, 10, 12]. Being less bony invasive, resulting less

surgical trauma as the drilling of tibial and femoral sockets over ACL footprints preserves the external cortex for the fixation, yet another advantage of this technique [8, 9]. Histological study that compared the graft healing after all-inside cortical-button suspensory fixation in sockets versus interference screw fixation in tunnels in a canine model, showed superior graft healing to bone both in femoral and tibial sockets in the all-inside technique. The grafts showed direct attachment to bone with a four-zone integration, similar to that of the non-injured ligament [13].

### Conclusion

Thus it can be concluded that Clear universalisation of the choice of technique is not possible. Functional recovery in All-inside group is faster up to 1st month however conventional trans portal group patients catch up with the All-inside group subjects by 6<sup>th</sup> month. Extension lag and flexion deficit recovery is faster in All-inside group however the final recovery is similar in both groups at 6 months. There is no difference between the two groups as far as laxity after reconstruction is concerned, both in the immediate short term and at 6 months. Thus both techniques are equally efficacious for the purpose. Activity level recovery was one grade higher in the All-inside group though the value obtained did not attain significance. Both techniques were equally efficacious in satisfying the expectations of the patients they had before the surgery.

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