

**ANTERIOR CRUCIATE LIGAMENT TEAR: DOES EARLY RECONSTRUCTION AFFECT THE FUNCTIONAL OUTCOME****A prospective study of 76 patients with 2 years follow up****Rahul Ranjan\*, Naiyer Asif, Mohammad Jeshan Khan, Latif Zafar Jilani**

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**Keywords:** Anterior cruciate ligament, IKDC score, Lysholm score, early reconstruction, range of motion

**Abstract**

Background and purpose: It is a debatable subject that, early ACL reconstruction has better outcomes than the delayed one. The purpose of this prospective study is to evaluate functional outcome following ACL reconstruction in the two cohort one with early and another with delayed reconstruction.

Patients and methods: Seventy six patients with ACL-deficient knees that met inclusion criteria underwent ACL reconstruction using quadrupled hamstring autograft by one surgeon. Patients were grouped into two groups on the basis of simple random sampling. patients in the group I underwent ACL reconstruction within 8 weeks after injury and patients in group II after 8 weeks of injury. All patients were subjected to same post-operative rehabilitation protocol. All the knees were observed in a prospective manner with a subjective and an objective functional outcome score, and range of motion at 2, 8, 14, 24, 52-weeks and 2-year interval.

Results: Range of motion was less in the group I in the first 24 weeks, and the difference was significant ( $p < 0.01$ ). At one and two years of follow-up the difference was not significant ( $P < 0.01$ ). The IKDC and the Lysholm score was apparently better in the group II but the difference was significant till 52 postoperative week ( $p < 0.01$ ) and was not significant at second postoperative year.

Conclusion: There is no advantage in early reconstruction for the ACL insufficiency. Delayed surgery, allow the surgeon to assess more carefully a patient's suitability for the surgery.

**Introduction**

Anterior cruciate ligament (ACL) rupture is a common knee injury with a recent estimated incidence of 81 per 100,000.<sup>4</sup> The majority of ACL injuries (~70%) occurs while playing agility sports and the most often reported sports are basketball, soccer, skiing, and football. An estimated 70% of ACL injuries are sustained through non-contact mechanisms, while the remaining 30% result from direct contact.<sup>8</sup>

There are then two schools of thought 'early reconstruction and structured rehabilitation' and 'structured rehabilitation with delayed reconstruction only if required'. Generally about a third of patients who only have structured rehabilitation later undergo ACL reconstruction due to instability.<sup>17</sup> It has been shown that early ACL reconstruction reduces the incidence of early OA in ACL deficient patients who are intent on continuing activities that involve sidestepping and pivoting activities.<sup>10</sup> It has been shown that delaying surgery by about 6 weeks is probably optimal time for reducing the risks of deep vein thrombosis (DVT)<sup>1</sup>, without compromising the knee significantly. Postoperative stiffness of the knee is a well-recognised complication of reconstruction of the anterior cruciate ligament (ACL).<sup>9,18,19</sup> In particular, early reconstruction after tears of the ACL has been associated with an

increased incidence of stiffness and prolonged rehabilitation.<sup>21</sup> A delay in surgical reconstruction also has a potential morbidity, such as inability to return to employment or sporting activities, as well as an increased risk of meniscal damage from further injuries because of instability of the knee.<sup>11</sup> Currently, many surgeons prefer to treat injuries of the ACL with an initial period of rehabilitation followed by reconstruction two months or more after the injury.<sup>20,21</sup>

In this study, we have analyzed the objective and subjective functional outcome following early and delayed reconstruction of the ACL reconstruction using hamstring graft in order to determine the whether there was advantage of early reconstruction.

### **Patients and methods**

We examined 76 patients, presented acutely in our Arthroscopy and sports clinic with the feature suggestive of ACL tear. Inclusion and exclusion criteria for this study have been enlisted in Table 1.

In this prospective study, we randomized the patients who fulfilled the inclusion criteria, using simple random sampling, into two groups. Early reconstruction of the ACL (group I), those who underwent reconstruction within 8 weeks of injury, and delayed (group II) who were treated after 8 weeks. All patients exhibited at least grade II Lachman test on preoperative clinical examination. The acute ACL injury was advised active physiotherapy in order to achieve full range of motion and minimal residual swelling. Subsequently repeat a clinical examination for knee instability was done to confirm ACL insufficiency, and ACL reconstruction was performed using quadrupled hamstring graft.

All patients agreed to participate in this study with ethical committee approval from concerned authority. From March 2012 to March 2013, 76 patients were prospectively examined and underwent surgical reconstruction. Of these, 74 patients fulfilled the study inclusion criteria as one had fractured in other knee and another had previous history of meniscectomy in the index knee. One patient did not give consent to participate in this study. A further study was carried out on 73 patients with 35 patients in group I and 38 patients in group II. Group allocation was performed using simple random sampling.

In all patients, arthroscopic anatomical single bundle ACL reconstruction was performed by our senior author. The graft used to reconstruct the ACL was the ipsilateral 4-strand semitendinosus and gracilis tendons. Round head titanium cannulated interference screws (RCI, Smith & Nephew, Andover, USA) for distal fixation, and for proximal fixation suspensory device (EndoButton, Smith & Nephew, Andover, USA) were used. All patients were followed at least up for two years. Both groups of patients were reviewed at two, eight, 14, 24, 52 weeks and finally at two years. We lost follow-up of one patient in group II after 12 weeks, and was excluded. In two patients of group I, graft failure was reported due to re-injury, one at 9<sup>th</sup> post-operative week and another at 12<sup>th</sup> week, and we excluded them for an estimation of functional outcome but included them in complication. Finally, we had 33 patients in group I and 37 patients in group II till recent follow up.

In order to remove the bias, the physiotherapist was blinded. Both groups of patients were treated by similar rehabilitation schedule. This concentrated particularly on the management of the soft tissue swelling, the recovery of full extension of the knee and muscle control, and on proprioception exercises. The rehabilitation program was instituted, focusing on achieving full extension at 14<sup>th</sup> day after surgery. Full functional activity like running and sporting activity was encouraged only after knee stability had been reconfirmed on clinical examination, and usually after 8<sup>th</sup> month post-operatively.

All patients were assessed by an independent examiner before surgery, at two, eight, 14, 24, 52 weeks and finally at two years using the International Knee Documentation Committee (IKDC) evaluation form. The Lysholm Knee Score was obtained using self-administered questionnaire. The range of movement was measured with a long-arm

goniometer. Any postoperative complications were recorded. We expressed the functional outcome for the injured knee as a percentage gain in movement when compared with the contralateral normal knee.

### Statistical analysis

A comparison of means was carried out using Student's *t*-test. The outcomes were compared between the two groups using the Mann-Whitney *U* test for unpaired non-parametric data and the Wilcoxon signed rank test was used to assess changes over the time. Linear regression analysis was performed to assess the relation between selected dependent and independent variable. Statistical significance was set at the 1% level to attain more strictness of the null hypothesis.

### Results

The mean age was 28.5 years in the group I and 28.7 years in group II ( $p = 0.85$ ). In this study there were 30 males in group I and 34 males in group II. Most common mode of ACL injury in our study was road traffic accident in 24 patients in group I and 28 in group II followed by sporting activities. The dominant side of the knee was involved in 22 patients in group I and 26 patients in group II. Meniscal tear were present in 9 patients in group I and 16 patients in group II. During arthroscopy chondral damage was observed in three patients in group I and eight in group II.

**Range of motion.** The range of motion was less in group I for all measurements made in the first 24 weeks after surgery. The difference was significant ( $p < 0.01$ ) at two, eight and 14 weeks. The apparent difference was seen throughout the follow-up, but it was more evident during first six months. At one ( $p = 0.9$ ) and two ( $p = 0.4$ ) year of follow-up difference in the range of motion in both groups was not significant. Significant residual extension deficit ( $> 5$  degree) was present in one patient in the group I but none in the group II. On further evaluation arthrofibrosis was evident, for which arthrolysis was performed. In one patient of group II in spite of being infection at tibial fixation site, range of motion was reasonable ( $120^{\circ}$ ). The mean range of motion at final follow-up in group I was 99.5% and in group II, it was 99.8% ( $p=0.4$ ) [table 2 and figure 1].

**Functional outcome.** IKDC score was apparently better in the group II, but the difference was significant till 52 weeks post-operatively ( $p<0.01$ ). There were no significant differences in the IKDC score at second year of follow up ( $p = 0.06$ ) [table 3 and figure 2]. One patient in the group I developed arthrofibrosis, for which successful arthrolysis was performed. This impaired the functional score at 24 weeks post-operatively of that patient. One patient in group II developed infection at tibial fixation site, which was controlled after administer of appropriate antibiotic and subsequently healed with an unsightly scar. This infection leads to low IKDC score during 12 to 24 weeks, but score improved dramatically when the infection subsided. The Lysholm score also followed the same pattern of improvement, and there was no significant difference at 2 years of follow up ( $p = 0.04$ ) [table 4 and figure 3]. Another significant finding in this study was that mean IKDC and Lysholm score decreased drastically from pre-operative value of in the second post-operative weeks, and it improved gradually.

**Complications.** We observed graft failure in two patients of group I. one of nine post-operative weeks and another at 12 post-operative week. In both patients it was due to significant re-injury. In one patient of group I, there was arthrofibrosis diagnosed at 24<sup>th</sup> week. Range of motion and functional outcome was low at this stage. The patient was further planned for arthroscopic arthrolysis, and he gained a reasonable range of motion and good IKDC (82 points) and Lysholm score (90 points) at the final assessment. Postoperative delayed infection at the graft harvesting site was observed in one patient in group I and none in the group II. Patients refused for surgical debridement and hence intravenous antibiotic was given according to sensitivity. Subsequently, it healed with and ugly scar in around 6 weeks of antibiotic administration. One patient in the group II had painful, infected tibial fixation post at 52<sup>nd</sup> week of follow-up, and it was removed subsequently. The saphenous neuralgia was also a noted complication. It was there in 12 patients of group I and 10 patients in the group II. Although complications were more apparent in the group I but the difference was not significant ( $p = 0.2$ ) [table 5].

## Discussion

The appropriate time for ACL reconstruction is a controversial issue. Early surgery runs the risk of arthrofibrosis and results in unpredictable results<sup>3</sup>, which also affect the achieved range of movement.<sup>16</sup> Late surgery carries the risk of increase in the chance of having meniscal, chondral or early osteoarthritis.<sup>12,15</sup>

Marcacci et al. compared a group of patient who underwent early reconstruction, within 2 weeks of injury (group I), with a group of delayed reconstruction, more than 3 months after injury (group II). They found that the results were better in the group who underwent early reconstruction. They also had more stable knees, less chance of having associated injuries and a higher percentage of return to sport activity (91% vs. 71%). IKDC and the Lysholm score was also better in group I patients. They also concluded that irrespective of the technique used early ACL reconstruction should be advocated in young patients with high professional motivations to prevent secondary injuries without having the risk of loss of motion.

In the few previous studies have shown that concomitant ligamentous and meniscal injuries as well as time from injury to surgery were not significant predictors of functional outcome after ACL reconstruction.<sup>13,22</sup> Whereas, Laxdal et al. in his study found that a longer time from injury to surgery, associated meniscal and chondral damage were poor prognostic factors for return to sports, patients-reported outcome and function.<sup>14</sup>

We have not found any evidence to suggest that early reconstruction is beneficial to the patient with acute rupture of ACL. The return of the motion was more slowly in the patents of the group I. However, the difference was not significant beyond 24<sup>th</sup> week post-operative follow-up. Significant differences in the functional outcome was evident till 52<sup>nd</sup> post operative weeks. After this both the groups did well. This difference was probably because the road traffic accident was the common mode of injury in this study, and it's usually associated with other associated injuries. A post-traumatic soft tissue injury usually heals in 12 to 24 weeks. On the contrary to the study cited above we could not found clinically significant difference in associated meniscal and chondral damage in both the groups. This probably because the secondary damage might not be evident within 8 weeks post ACL tear. There was apparently more number of complications in the early group but the difference was not statistically significant. We also observed the marked decrease in the IKDC and the Lysholm score in second post-operative weeks. This was probably due to post-operative pain and restriction of the certain activities as per rehabilitation programme. In the term of achieved functional score our study well correlates with the study done by Karlsson et al. and Meighan et al.

Karlsson et al. in his study also found that a delay in surgery was associated with decrease in the desired level of activity as compared to the early surgery group. They also reported no difference between the groups in the term of Lysholm score, the IKDC evaluation system and the one-leg-hop test, but meniscal injuries were significantly more frequent if the index surgery was delayed.<sup>11</sup> Likewise, Meighan et al. in a randomized control study comparing acute versus sub-acute repair found no difference in the outcome estimated by the IKDC score at the end of 52 weeks. But, they reported a decreased ultimate range of motion in the acute group as well as decrease quadriceps strength.<sup>16</sup> They finally, concluded that there was no functional advantage to be gained by early reconstruction of the ACL.

In our study we used hamstring graft for both groups. Many studies have observed the difference between graft tissue and graft source, still the significance of either on patient-oriented outcome is not clear. In a meta-analysis conducted by Goldblatt et al. found no significant difference between hamstring and patella tendon graft in term of IKDC, Lysholm or Tegner score.<sup>6</sup> Similarly, Goradia et al. concluded that hamstring tendons are an excellent graft choice in both acute and chronic injuries of the ACL. According to the strict IKDC rating system, greater than 90% of all patients can be expected to have a normal or near normal knee at short- to intermediate- term follow- up; however, the chronic group will have fewer patients with a rating of normal. They also observed significantly more cartilage and partial medial meniscal injuries in the chronic group.<sup>7</sup>

The strength of our study are prospective study, uniform follow-up observation and was made by an independent observer not involved in the original surgical procedure or rehabilitation, a strong statistical input, and all the reconstruction were performed by one surgeon. There are a few limitations of this study like small sample size and other potential predictors of functional outcome, like tunnel position, knee shape, patient self-efficacy, motivation, compliance and expectations. Thomee et al. found that pre-operative self-efficacy of future knee function (K-SES, part D) was a significant predictor of patient-reported outcome one year after ACL reconstruction.<sup>23</sup> Eggerding et al. reported that patients who had a smaller intercondylar notch and smaller width of intercondylar eminence had higher subjective score.<sup>2</sup> Gobbi et al. found that a psychological profile, which measure patient expectations and motivations, may be useful in predicting which patients undergoing ACL reconstruction are more likely to return to their pre-injury activity levels.<sup>5</sup> These psychological factors and patient's expectations of surgery should be taken into account when attempting to predict patient-oriented outcome following ACL reconstruction. Postoperative complications were more apparent in the group I patients but its clinical significance cannot be estimated due to less sample size in both groups. This small sample size was mainly due to restriction in access to orthopedic emergency, poor referral system and strict inclusion criteria, and hence contributed to the difficulty in recruiting large numbers of patients.

### Conclusion

There is no advantage in early reconstruction for the ACL insufficiency. A delay in presentation to a sports surgeon should not be a factor in denying the patients for surgery. Delayed surgery is associated with a more rapid return of motion and also allows the surgeon time to assess more carefully a patient's suitability for reconstruction of the ACL.

*Table 1: Inclusion and exclusion criteria*

Inclusion criteria	Exclusion criteria
<b>Acute ACL injury reported within 2 weeks</b>	Any associated ligament injury requiring surgery
<b>Age less than 40 years</b>	Previous meniscectomy
<b>Physically active individual</b>	Abnormal radiograph
<b>No associated injury to medial collateral tear</b>	Abnormal contralateral knee
<b>No previous ligament injury or surgery</b>	Patients who did not wish to enroll in this study
<b>No previous meniscal injury</b>	Patients who were not treated using quadrupled hamstring graft

*Table 2: Mean range of motion*

Time (post operatively)	Group I (in degree)	Group II (in degree)	p value
<b>2 week</b>	29.00	37.02	<0.01
<b>8 week</b>	49.21	59.14	<0.01
<b>14 week</b>	61.76	73.70	<0.01
<b>24 week</b>	86.33	87.81	0.05
<b>52 week</b>	97.24	97.21	0.9
<b>2 year</b>	99.58	99.78	0.4

**Table 3: Mean IKDC score**

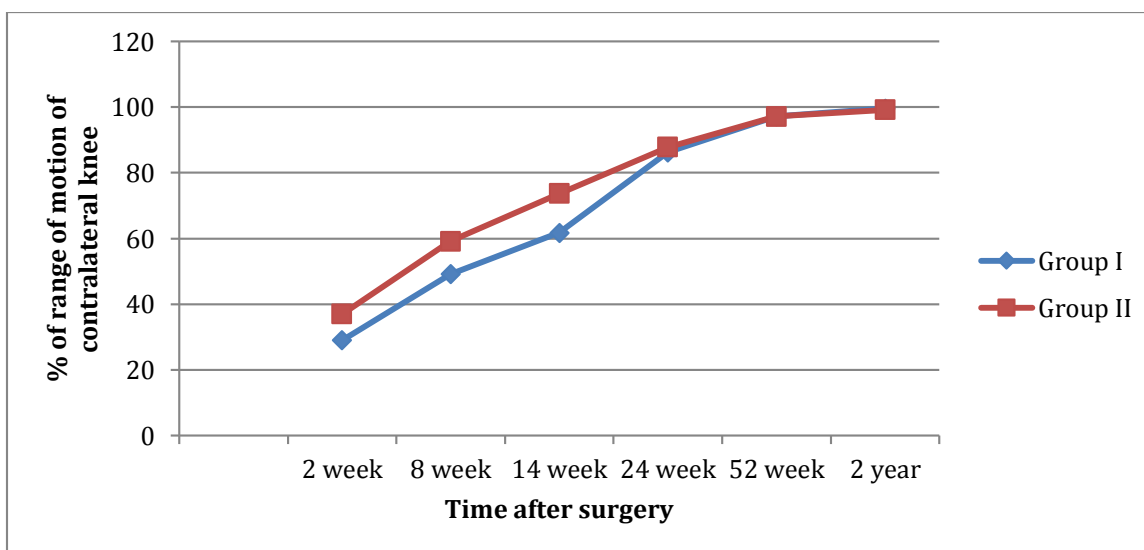
Time	Group I	Group II	p Value
Preoperative	34.14	34.59	0.9
2 week	14.28	17.57	<0.01
8 week	30.18	37.02	<0.01
14 week	50.11	56.95	<0.01
24 week	72.39	79.85	<0.01
52 week	81.85	85.25	<0.01
2 year	89.85	90.26	0.06

**Table 4: Mean Lysholm Score**

Time	Group I	Group II	p Value
Preoperative	50.30	54.21	0.08
2 week	37.29	49.00	<0.01
8 week	56.60	64.75	<0.01
14 week	70.12	79.68	<0.01
24 week	82.79	89.19	<0.01
52 week	90.48	92.84	<0.01
2 year	93.30	94.35	0.04

**Table 5: Complications**

Complication	Group I	Group II
Failure	2	0
Arthrofibrosis	1	0
Infection	1	1
Saphenous neuralgia	12	10
<b>Total</b>	<b>16</b>	<b>11 (p = 0.2)</b>



**Figure 1: Graph showing improvement in range of motion in two groups**



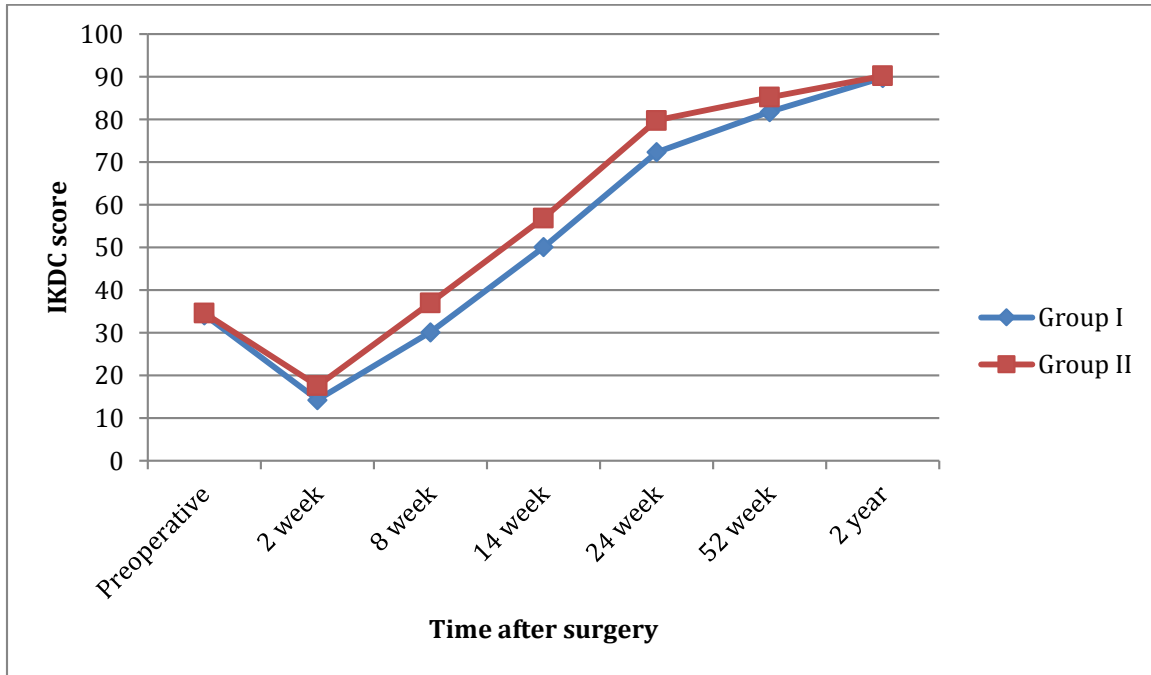


Figure 2: Graph showing improvement in the IKDC score.

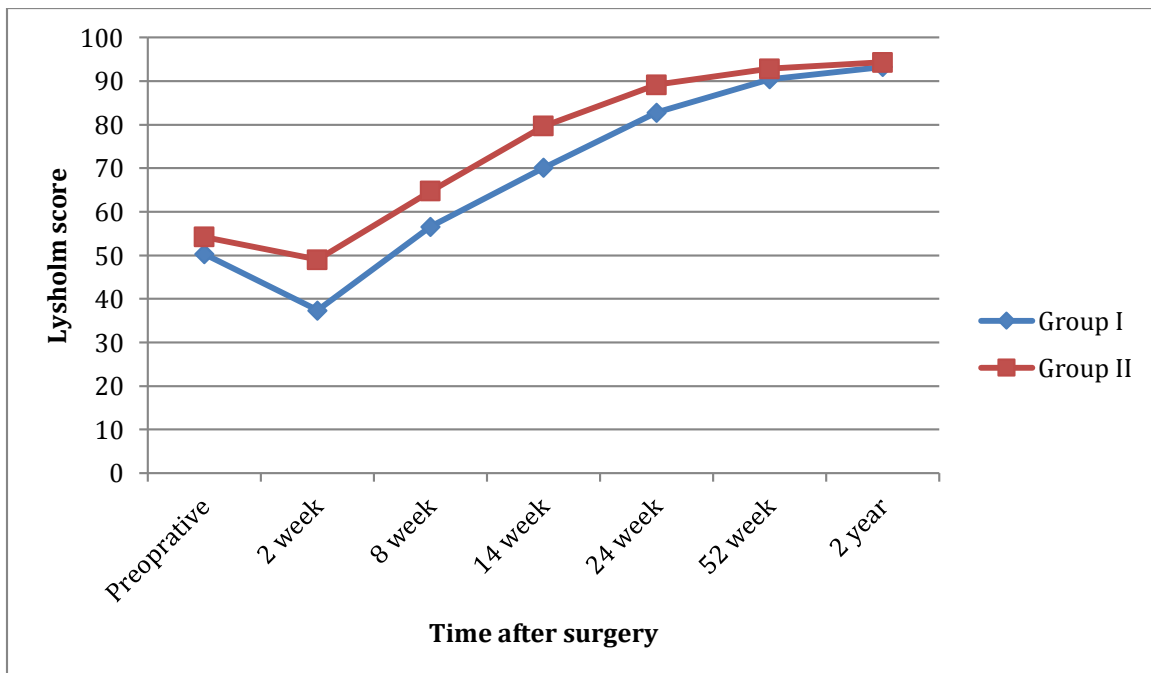


Figure 3: Graph showing improvement in the Lysholm score

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