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Accelerated rehabilitation is vital post anterior cruciate ligament reconstruction

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Abstract

An ideal rehabilitation program post anterior cruciate ligament reconstruction enables an individual to return to pre injury levels at a faster rate with minimal to no risk of reinjury to the graft.

The aim of our study is to assess the outcome of accelerated rehabilitation post anterior cruciate ligament (ACL) reconstruction. A rehabilitation program for a duration of 6 months is sufficient when compared to 9 months 106 patients were operated by a single surgeon underwent arthroscopic anterior cruciate ligament reconstruction using quadrupled semitendinosus and gracilis graft and partial meniscectomy for associated meniscal tear. Patients were put on an accelerated rehabilitation protocol designed in our institute on first post-operative day, under the guidance of a physical therapist in consultation with the operated surgeon.

Patients were followed up at 3weeks, 6 months and 9 months post onset of rehabilitation. Patients were assessed using KT1000 Arthrometer and Lysholm knee scoring system.

Out of 106 patients, who were selected, 96 (91%) were males and 10 (9%) were females.

The mean pre-operative Lysholm score was 55.09. Post operatively, while on accelerated rehabilitation program the Lysholm scores were 69.73 at 3 weeks, 89.13 at 6 months and 89.19 at 9 months. In our pre-operative evaluation mean KT 1000 arthrometer score was 10.53 and post-operative at six months was 3.49. At nine months 105 patients had excellent results whereas 1 patient had good result.

Accelerated rehabilitation protocol enables the patient to functionally recover faster to pre injury levels. A rehabilitation protocol for 6 months is sufficient in enabling a patient to get back to pre-injury levels. Functional outcome is the same with or without associated meniscal injuries. KT 1000 knee Arthrometer plays a vital role in diagnosing anterior cruciate ligament injuries and can be used to compare preoperative and post-operative ligament status.

Keywords: Accelerated rehabilitation protocol, anterior cruciate ligament (ACL) reconstruction, KT 1000 knee arthrometer, lysholm knee score, prospective stud

Introduction

Anterior Cruciate ligament reconstruction restores knee function to pre injury levels, without any pain. It also prevents degenerative changes in the knee. Anterior cruciate ligament, it also allows the patient to return to sporting activities ^[1].

The rationale for rehabilitation after an anterior cruciate ligament injury is to gain a good functional stability, reach the best possible functional level and to decrease the risk for re-injury. The training programs are focused both on the injured leg, but also on the non-injured leg, hip and trunk muscles that are needed in order to stabilize the entire body. The functional stability of the knee joint is dependent on the interplay of passive structures and the dynamic system. The ligament provides an average of 86% of the total resisting force to anteriorly directed forces on the tibia ^[1].

Rehabilitation protocols have changed considerably over time in the past. It has become “aggressive”, meaning an intensive rehabilitation which includes greater variety of exercises and sports related training. The aim of post-operative rehabilitation after anterior cruciate ligament reconstruction is to restore normal joint motion and strength, and lower extremity performance reaching pre injury levels without producing excessive stress and strain on graft during healing and also to prevent re injury ^[1].

AIM of study

The aim of our study is to assess the outcome of accelerated rehabilitation post anterior cruciate

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ligament (ACL) reconstruction. A rehabilitation program for a duration of 6 months is sufficient when compared to 9 months

Materials and Methods

One hundred and six arthroscopic anterior cruciate ligament reconstructions using quadrupled semitendinosus and gracilis grafts were performed. Meniscal injuries if associated was treated by partial meniscectomy. This prospective study was conducted over a period of four years (2015-2019) at Vydehi institute of medical sciences and research center Bangalore in the department of Orthopaedics

All patients were examined pre-operatively in the outpatient by a senior orthopaedic surgeon. Evaluation was done clinically and also using K.T 1000 Arthrometer. Magnetic resonance imaging was done for all patients before surgery

Patients with unilateral Anterior cruciate ligament insufficiency, injury at least one month prior to surgery, instability during activities of daily living, associated with other ligament and meniscal injuries and no previous reconstruction of any of the ligaments were selected as study population. Patients with bilateral insufficiency, associated fractures in same limb and those put on delayed rehabilitation protocol were excluded. Following surgery, patients were prescribed on an accelerated rehabilitation protocol designed at our institute (table 1) from day one. The rehabilitation was supervised by trained rehabilitation therapist in coordination with the surgeon. Follow up was done at 3 weeks, 6 months and at 9 months using the Lysholm knee score ^[2, 3], and KT-1000 Arthrometer ^[4, 5].

Lysholm score has both subjective and objective evaluation. The score carries maximum points for instability and pain. The maximum points is 100. Patients are graded pre operatively and post operatively as excellent, good, fair and poor.

Scores

81-100 excellent
71-80 good
61-70 fair
<60 poor (table2)

Observations

Out of 106 patients, who were selected, 96 (91%) were males and 10 (9%) were females. The commonest mode of injury was road traffic accident 43(41%); this may be due to increased incidence of two wheeler accidents. This was followed by non-sports twisting injury in second place 41(39%), we found out that majority 61% of the patients were in age group of 21 to 30 years. Of the 106 patients who were studied, out of which males were 96(91%) and females were 10(9%)

Results

The mean pre-operative Lysholm score was 55.09. Post operatively, while on accelerated rehabilitation program the Lysholm scores were 69.73 at 3 weeks, 89.13 at 6 months and 89.19 at 9 months (figure 1). In our pre-operative evaluation mean KT 1000 Arthrometer score was 10.53 and post-operative at six months was 3.49. At nine months 105 patients had excellent results whereas 1 patient had good result.

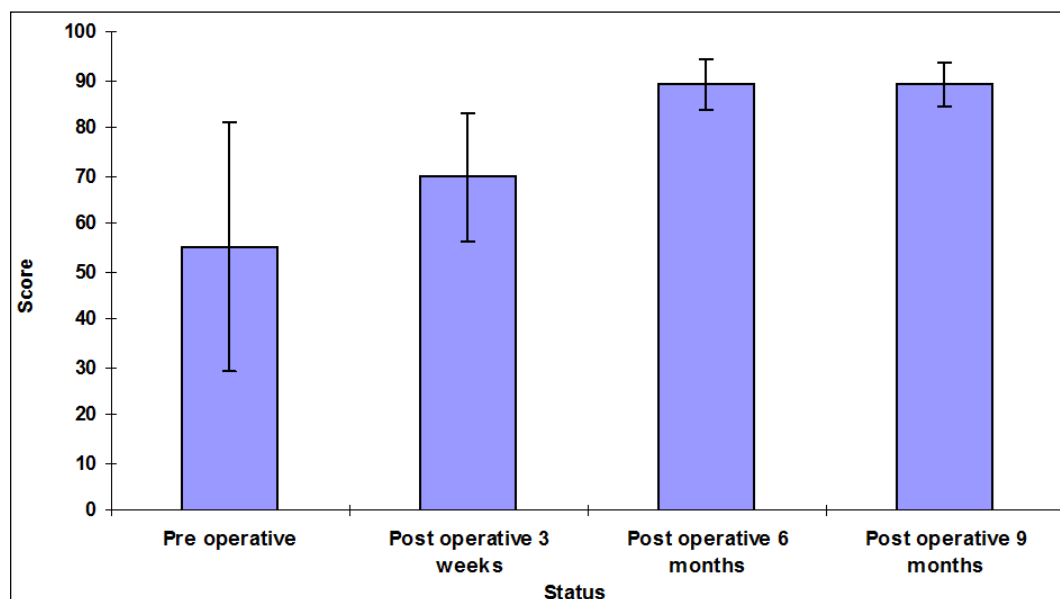


Fig 1: Mean Lysholm score

Discussion

Aim of rehabilitation following anterior cruciate ligament reconstruction is to enable the patient to get back to pre-injury levels without having the risk of re injury.

In the present study, we found out that majority (65 patients and 61%) of the patients were in age group of 21 to 30 years. This shows that anterior cruciate ligament injuries are common in the highly active age group, thus it becomes a priority to restore them to pre injury levels as early as possible.

All the patients were screened in the outpatient department clinically and using K.T 1000 knee arthrometer. A difference of 4 mm on KT 1000 was considered significant when compared to the opposite knee. Our study indicated tear in all

the 106 patients (100%). In a study conducted by Bach *et al* KT 1000 is 95% sensitive in detecting anterior cruciate ligament injuries ^[6].

K.T 1000 values of pre-operative and post-operative were compared in paired t test which showed t value (96.73 df = 207) and p value (2.8×10^{-17}). This shows that there is significant improvement in the outcome of the patients post operatively in patients who have undergone anterior cruciate ligament reconstruction followed by an accelerated rehabilitation program. There is no statistical significant difference at end of 6 months and at 9 months In KT1000 Arthrometer readings.

At 6 months the mean Lysholm score was 89.3, shows that the functional recovery of the operated and rehabilitated

(accelerated) knee is excellent, which is comparable to the study of Shelbourne *et al.* who showed that a score which is 85% of the normal knee is sufficient to get the patient back into pre-operative activity level [7, 8].

Statistical analysis was done using the paired t test which showed the following (table 3)

There is no statistical significant difference at end of 6 months and at 9 months. This is comparable with the findings of Shelbourne, Nitz *et al.*, [9] Marcacci *et al.*, [10] and Freedman *et al.* [11] This indicates that only 6 months of accelerated rehabilitation protocol is sufficient.

In the present study 57 (48%) of the patients had associated meniscal injuries. The outcome in rehabilitation in them was no different from the patients who did not have meniscal injuries at end of 6 months. This is comparable to the study done by Barber *et al.* [12] and Bellabarba *et al.* [13] In their study Barber *et al* followed up their patients for two years and found out that re tear of meniscus was only 8 to 13% (development of pain and disability). None of our patients developed any re tear during the course of rehabilitation.

In our rehabilitation program, patients were started on partial weight bearing on post-operative day one, with weekly increments in weight bearing till patient started unaided gait at

end of 3 weeks post operatively. At end of three weeks patients were allowed only normal walking. None of the patients complained of any instability. This is comparable to the study conducted by Tyler *et al.* [14] The advantage of early and incremental weight bearing is that patient is able to get back to day to day activities in a shorter time frame and simultaneously the graft is not subjected to strain.

Patients on accelerated rehabilitation regain lower limb muscle strength earlier when compared to delayed rehabilitation. Early recovery of muscle strength gives additional stability and help in returning to sporting activities at a faster rate compared to delayed rehabilitation without causing stress on the graft [15].

In the rehabilitation protocol we introduced proprioceptive exercises at eight weeks, which helps in improving the nervous system's ability to generate a fast and optimal muscle contraction, enhance coordination and balance and to relearn movement patterns and skills. The importance of neuromuscular training has been demonstrated in prospective controlled studies where the incidences of anterior cruciate ligament injuries were significantly lower in athletes who participated in proprioceptive training, as described by Fitzgerald *et al.*, [16] and Zatterstrom R *et al.* [17].

Table 1: The accelerated rehabilitation protocol designed and followed in our institute

	week1	week2	week3	week 4-8	2 to 4 months	4 months	5 months	6 months
Active, active assisted and gentle passive ROM exercises.	+							
Gait toe walking assisted with axillary crutches.	+							
Isometric quadriceps: hamstrings::1:2	+							
Gait, 50% weight bearing with axillary crutches		+						
Active and active assisted knee ROM exercises.		+						
Isometric quadriceps: hamstrings::1:2		+						
Straight leg rises.		+						
Gait, 75% weight bearing with axillary crutches 7			+					
Active and active assisted knee ROM exercises.			+					
Isometric quadriceps: hamstrings::1:27			+					
Straight leg rises.7			+					
Extension exercises			+					
Full weight bearing gait				+				
Active, active assisted knee ROM				+				
Hamstring and quadriceps strengthening				+				
Quarter squats				+				
Custom knee brace				+				
Stationary bike				+				
Cycling					+			
Jogging					+			
Swimming					+			
Trampoline					+			
Proprioception exercises					+			
Sports specific skills						+	+	+
Continue hamstrings and quadriceps strengthening						+	+	+
Continue proprioception exercises.						+	+	+

Table 2: Lysholm Knee score

1.	LIMP (5 points)	
	None	5
	Slight or periodic	3
	Severe/Constant	0
2.	Support (5 points)	
	None	5
	Cane/crutch needed	3
	Unable to bear weight	0
3.	Locking (15 points)	
	None	15
	Catching	10
	Occasional	6

	Frequently	2
	Currently locked	0
4.	Instability (25 points)	
	Never gives way	25
	Rarely with sports	20
	Often with sports	15
	Sometimes with ADL's	10
	Often during ADL's	5
	Every step	0
	Pain (25 points)	
5.	None	25
	Slight or periodic	20
	Severe/Constant	15
	Marked walking > 2 km	10
	Marked walking < 2 km	5
	Constant	0
6.	Swelling (10 points)	
	None	10
	After sports	3
	After daily activities	2
	Constant	0
7.	Stairs (10 points)	
	No problem	10
	Slight problem	6
	One step at a time	2
	Impossible	0
8.	Squatting (5 points)	
	No problem	5
	Slight problem	4
	Not beyond 90°	2
	Impossible	0

Table 3: Statistical Analysis

Lysholm score	Mean ± Sd	a and b	b and c	c and d	a and d
Pre operative (a)	55.09 ± 13.07				
3 WKS Post operative (b)	69.73 ± 6.74				
6 Months post operative (c)	89.13 ± 2.68				
9 Months post operative (d)	89.19 ± 2.26				
t	-	10.24	27.56	0.17	26.46
p-value	-	3.53 x 10 ⁻¹⁹	9.7 x 10 ⁻⁵⁸	0.8681	9.35 x 10 ⁻⁵⁰
Statistical significance	-	Very highly significant	Very highly significant	Not significant	Very highly significant

Conclusion

Accelerated rehabilitation protocol enables the patient to functionally recover faster to pre injury levels. A rehabilitation protocol for 6 months is sufficient in enabling a patient to get back to pre-injury levels. Functional outcome is the same with or without associated meniscal injuries. A good rehabilitation program is vital for an excellent surgical outcome.

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