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Comparison of Functional Outcome with and without Early Bracing Post ACL Reconstruction

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Abstract

Objective: To compare the outcome with and without functional knee bracing post arthroscopic ACLR in 100 patients.

Study design: Prospective randomized comparative study. Level of evidence: Level 1.

Material and methods: Patients who meet the inclusion and exclusion criteria underwent arthroscopic ACL reconstruction using hamstring graft. Patients were randomized into two groups-study group (with brace) and control group (without brace). The study group was given a functional knee brace round the clock except while doing Rehab exercises and bathing post-operatively for a period of 6 weeks. Other than the use of braces, the rehabilitation protocol was same for both the groups. Patients were followed up at 6 weeks, 3 months and 6 months following surgery with help of Lysholm score, IKDC score and Tegner activity levels.

Results: Out of all the patients, only 4 patients (2 each in study and control group) were not available for follow up at 6 months. No complications of graft failure, infection, re-injury, DVT, vascular or neurological injuries were seen. The average Lysholm score of the study group and control group at 6 weeks was found to be 76 and 78. At 3 months the average scores improved to 82 and 81.92 and at 6 months the scores were 96.76 and 96.92. The average IKDC score of the study group and control group was found to be 74.18 and 74 at 6 weeks, 82.14 and 82.6 at 3 months, 96.76 and 90.06 at 6 months. The average Tegner activity level of the study group and control group was found to be 1.4 and 2 at 6 weeks, improved to 3.14 and 3.22 at 3 months and the average scores at 6 months were 5.08 and 5.34 in the two groups. The Lysholm, Tegner and IKDC of both groups were found to be comparable. The p-values at 6 weeks, 3 months and 6 month of Lysholm, Tegner and IKDC scores were not significant (>0.05)

Conclusion: The prospective, randomized study comparing patients post ACLR with and without a functional brace fail to show any statistically significant difference at 6 months follow up.

Keywords: Arthroscopic ACLR; Neurological injuries; Patients; Hamstring graft

Introduction

The Anterior Cruciate Ligament is one of the most commonly injured ligament of the knee The ACL is the primary restraint to anterior tibial displacement, responsible for approximately 85% of the resistance to the anterior drawer test when the knee is at 90 degrees of flexion and neutral rotation. Anterior Cruciate Ligament (ACL) tears are commonly treated with surgical reconstruction to allow patients to return to an active lifestyle. Postoperative rehabilitation is critical to the successful outcome of surgical reconstruction. The physical presence of the brace during rehabilitation may improve patient confidence. Knee braces can be of the following types-knee immobilizer brace, which helps to maintain the knee in full extension, hinged knee braces, which help in patients with medial or lateral instability, knee ROM braces, which permit range of motion of the knee and offloading braces which are used in patients with osteoarthritis [1].

Reported disadvantages of postoperative functional braces include an increased risk of subsequent injury when braces are worn improperly, the potential for muscle atrophy, reduction of knee extension velocity, decreased patient perception of maximal performance, increased fatigability during exercise, and additional cost. The purpose of this study is to evaluate the functional outcome of using a functional brace in patients who have undergone ACL reconstruction.

Aim

To compare the outcome with and without functional knee bracing post arthroscopic ACLR in 100 patients.

Inclusion criteria:

- Unilateral ACL tears
- Age less than 40 years
- ACLR done with hamstring graft
- The graft will be fixed using cortical suspensory device/ aperture fixation screw over femur and aperture fixation screw over tibia

Exclusion criteria:

- Age>40 yrs
- Chondral defects of femoral/tibial condyles
- Associated extensive meniscal tears requiring repair/subtotal/ total menisectomy
- Associated articular/periarticular fractures
- Associated PCL/MCL/LCL injury
- Associated osteoarthritis of knee
- Revision ACLR
- Associated generalized ligament laxity
- Bilateral ACL tears

Materials and Methods

Source of data

The study has been conducted in a tertiary care hospital on patients meeting the mentioned inclusion and exclusion criteria.

Study period: 18 months, from April 2019 to September 2020. Cases will be followed up at 6 weeks, 03 months and 06 months following surgery.

Study design: Prospective randomized comparative study.

Sample size: 100 patients undergoing ACLR at our Centre.

Study design

This is a prospective, randomized, comparative study regarding functional outcome of bracing post ACL reconstruction surgery. Patients who meet the inclusion and exclusion criteria who shall be operated at our center were selected. Detailed history and findings of general, systemic and local examination of the patients was entered in pro-forma. X ray knee both AP view and lateral view were done pre-operatively [2]. Patients were subjected to MRI of the knee for pre op documentation of injuries. Patients were informed about this study. Written informed consent was taken. They were randomized into two groups- study group and control group before undergoing surgery. Fitness for the surgery was obtained. Under appropriate anesthesia, arthroscopic ACL reconstruction was done using Hamstring graft. Other than the use of braces, the rehabilitation protocol was same for both the groups [3]. The study group has been given functional knee brace round the clock except while doing Rehab exercises and bathing post-operatively for a period of 06 weeks. The control group has been observed without a functional knee brace. Cases were followed up at 06 weeks, 03 months and 06 months following surgery with help of Lysholm score, IKDC score and Tegner activity levels.

Results

Among the patients included in the study, there were 93 males and 7 female. Majority of them (84 out of 100) were young serving soldiers of the Indian Army while 16 were students and dependents of army personnel. This was largely attributed to high prevalence of ACL tear among young and active soldiers by virtue of them being involved in sports and military training including strenuous physical activities involving jumping, running and obstacle courses. The age group of patients in this study ranged from 16 to 39 years. The average age of patients was found to be 26.71. The average age of the study group was 27.4 and the average age of the control group was 26. The p-value being 0.2345 (>0.05, not significant). Various modes of injury in the present series is as per the following table. In all the following modes, the common mechanism involved is a twisting injury to the knee.

The most common mode of injury was sports injury (48 patients). The next common mode of injury was during military training (31 patients) (fall during 9 feet ditch jump, BPET) in which a soldier has to jump across a 9 feet long ditch with his rifle and backpack [4]. Road traffic accidents were responsible for injuries to 21 patients in the study. Clinical complaint of almost all the patients either instability or pain in the involved knee. Many of them also complained of locking of the knee. They also had various other associated symptoms like limp, difficulty in climbing stairs or going downstairs and difficulty in squatting on presentation to this hospital. The average time between injury to surgical repair was around 136.4 days. The average in study group 129.6 and that in control group is 143.2.

Out of all the patients, only 4 patients (2 each in study and control group) were not available for follow up at 6 months. However their scores at 6 weeks and 3 months have been included in the study. 1 patient had a complication intra-operatively. While drilling the femoral tunnel, a 4 mm drill bit tip broke while piercing the far cortex. Attempts to retrieve the broken drill bit failed. However patient did not have any functional limitation, pain or hardware symptoms post-operatively, during rehabilitation and at all follow ups. 03 patients c/o excessive swelling in their knee post-operatively, all of them were managed conservatively with ice pack application and limb elevation. No complications of graft failure, infection, re-injury, DVT, vascular or neurological injuries were seen. At 6 months post-surgery all patients were ambulant full weight bearing without support with no c/o pain in the affected knee [5]. All patients were able to carry out their activities of daily living without any complaint at the end of 6 months. However none of them were advised to return to sports activities. The Lysholm, Tegner and IKDC of both groups were found to be comparable. The p-values at 6 weeks, 3 months and 6 month of Lysholm, Tegner and IKDC scores were not significant (>0.05). The overall results of this study are summarized in the **Table 1**. In view of available evidence as provided from this study, it is concluded that there is no significant difference in function outcome of patients post ACLR in both the groups. The IKDC, Tegner and Lysholm scores of both the groups were comparable at 6 weeks, 3 months and 6 months.

	Study	Control	P value
Number of patients (total-100)	50	50	
Age/years (range)	16-39	17-36	

Average age (overall average-26.7)	27.4	26	0.6197
Gender (M/F) (Total-M-93; F-07)	47/03	46/04	
Laterality (left/ right) (total-44/56)	21/29	23/27	
Mode of injury: Sports injury	21	27	
Mode of injury: Training injuries	19	12	
Mode of injury: RTA	10	11	
Delay between injury and surgery (Average-136. 4 days)	129.6 days	143.2 days	0.0726
Pre-op Lysholm score	57.5	60.7	0.2309
Lysholm score at 6 weeks	76	78	0.3252
Lysholm score at 3 months	82	81.92	0.6182
Lysholm score at 06 months	96.76	96.92	0.6182
Pre-op IKDC Score	53.76	54.14	0.7556
IKDC score at 6 weeks	74.18	74	0.6763
IKDC score at 3 months	82.14	82.6	0.4633
IKDC score at 6 months	96.76	90.06	0.911
Pre-op Tegner activity level	2.52	2.5	0.9201
Tegner activity level at 6 weeks	1.4	2	0.0731
Tegner activity level at 3 months	3.14	3.22	0.579
Tegner activity level at 6 months	5.08	5.34	0.0632

Table 1: The p-values at 6 weeks, 3 months and 6 month of Lysholm, Tegner and IKDC scores were not significant (>0.05).

Discussion

After statistical analysis of data collected over the study period and a follow up of 24 weeks, results were obtained. These were compared with results of multiple studies done earlier using functional bracing post ACLR involving Lysholm, Tegner and IKDC scoring systems. Different studies comparing functional outcome at varying time periods are available in literature [6]. In our study, the average age of the patient undergoing ACLR is 26.7 yrs (Range-16 yrs to 39 yrs). The average age of the study group was 27.4 and that of the control group was 26 (p value>0.05, not significant). Most of the patients in the study were young serving soldiers. In a similar the study and control groups were 28.5 yrs and 25 yrs respectively. The mode of injury for ACL tear was predominantly sports injuries (48%) followed by injuries sustained during military training (31%). Road traffic accidents comprised of 21% of injuries. In a study of clinical characteristics of 4355 patients with ACL tear, 3383 patients were injured in sports activities (77.68%), 384 patients in daily living accidents (8.82%), 203 patients in traffic accidents (4.66%) and 383 patients (8.84%) due to other injuries (acrobatic performances, military training) [7].

In another study titled “the activity leading to ACL injury and the ability to resume duty following reconstructive surgery in Malaysian military patients” including 111 patients reported that ACL injury was mainly due to sports injuries (82%). Other modes of injuries included military training (14%) and road traffic accidents (4%). The average Lysholm score pre-operatively in the study group was 57.5 and control group was 60.7. Post ACL reconstruction at 6 weeks this score was 76 (study) and 78 (control). At 6 months the scores increased to 96.76 and 96.92 respectively. In a similar study conducted by Eva Moller et al. shows pre-op Lysholm scores as 76.5 in both groups, which increased 6 months post op to 94 and 95 respectively [8]. Another study conducted by Harilainen et al. the pre-operative Lysholm scores were 70 and 73 in the study and control groups [6]. The 1 yr post ACLR Lysholm score improved to 89 and 90 respectively. A prospective randomized studies conducts in the reported a similar result with pre-op Lysholm scores in study and control group being 85 and 74. At 2 years the post op scores are 95 in both groups [1].

The average Tegner activity level pre-operatively in the study group was 2.52 and control group was 2.5. Post ACL reconstruction at 3 months this score was 3.14 (study) and 3.22 (control). At 06 months the scores increased to 5.08 and 5.34 respectively. In a similar study conducted a report in injuries by showing pre-injury Tegner activity level as 7 and 6 in study and control groups. At 2 years follow up these scores were 6 and 5

respectively. Another study conducted by Harilainen, et al. the pre-operative Tegner activity level 3 in both groups. The 1 yr post ACLR Tegner activity level improved to 5 and 6 respectively. A prospective randomized study conducted by Eva Moller, et al. reported a similar result with pre-op Tegner activity level in study and control group being 2. At 2 years the post op scores were 6 and 5 in study and control groups [9].

A prospective and randomized study conducted on injuries to compared 50 patients with and without a functional level brace using Lysholm score, Tegner activity level, IKDC score, one leg hop test and KT-1000 arthrometer, Isokinetic muscle torque. The study group wore the functional brace for 3 weeks post-op as compared to 6 weeks in this study. The pre-op Lysholm score of both groups showed a significant difference, but the study at 2 year follow up concluded that there is no difference between the two groups. Though the sample size is smaller (as compared to this study), the quality of result is better because of the use of KT 1000 laxity meter, measurement of isokinetic muscle torque and a longer follow up. The study also used the visual analog scale and concluded that the group using the functional brace had less pain in the immediate post op period and fewer post-op complications like swelling, haemarthrosis [10]. Another randomized prospective study conducted by Moller E compared 62 patients with and without brace using Lysholm score, Tegner activity level, Visual analog scale, Measurement of knee ROM, knee circumference, laxity and isokinetic muscle torque. The study did not exclude meniscal injuries which could be a confounding factor. Though the sample size is smaller (as compared to this study), the quality of result is better because of the use of KT 1000 laxity meter, measurement of isokinetic muscle torque and a longer follow up. This study also concluded that there is no difference between the braced and non-braced group at 2 years follow up.

A level I study conducted by authors regarding compared 60 patients following BPTB ACL reconstruction, with and without knee brace [6]. The knee brace was applied for a period of 12 weeks post op. Similar parameters were used to compare the two groups. This study concluded that there is no difference in between the two groups at 2 years follow up which is equivalent to the result of our study at 06 months follow up. Kartus J, et al. conducted a study (Level II) where the ROM brace was applied to the study group for 3-6 weeks which was locked in full extension while walking and sleeping but permitted full ROM during exercise. 2 year follow up showed the result that is consistent with our study. A multicenter randomized study compared 100 patients, where one group was given a functional ROM brace for 3 weeks and the other group a knee immobilizer brace for 3 weeks. The 2 year follow up concluded no statistically significant difference in between the two groups. When compared with the studies in literature on the similar subject, certain advantages of our study include a more precise inclusion and exclusion criteria. Patients with meniscal injuries, Chondral damages and osteoarthritis were excluded from our study. These injuries may act as confounding variables and interfere with the results of the study. The study was randomized and he period for which the functional ROM brace was applied was the same in all patients (6 weeks). There were no major post-op complications, no cases of failure and none of the patients had to undergo a re-surgery [11].

While conducting this study we did notice a few shortcomings. There were multiple confounding factors which could not be dealt with while conducting this study. The surgical technique used in the ACLR was different from patient to patient. A total of 6 orthopaedic surgeons performed the ACLR, with 1 surgeon using the transtibial technique and the rest 5 surgeons using transportal technique. The positioning of the patient differed from surgeon to surgeon and so did the site of the arthroscopic portals. One of the orthopedic surgeons involved in the study used to routinely make 3 portals instead of 2. The incision used to harvest the Hamstring graft varied from horizontal, vertical, oblique or reverse J shaped. The implants used to fix the ACL at femur and tibia was based on their availability at our centre. Aperture fixation, cortical suspensory device with fixed loop and adjustable loop were used to fix the ACL at femur. Aperture fixation was predominantly used to fix the ACL at tibia. A tourniquet was used in all cases, however the operating time varied from 45 mins to 1 hour 48 mins (incision to closure).

We also consider that the follow up of just 6 months is insufficient in coming to a final conclusion. Cases should have ideally been followed up to 2 years or till the time they resume sports activities. The results would then be more conclusive as compared to the follow up of just 6 months. The use of KT-1000 arthrometer during all follow ups would also have helped to measure the anterior translation of tibia over femur post-surgery to compare both the groups, thus improving the quality of result of this study.

Conclusion

Arthroscopic ACL reconstruction is one of the most commonly performed surgeries on Orthopedics. Rehabilitation post ACLR has come a long way in the past few decades. It plays a very important role in getting patients back to sports activities. Functional bracing Post-ACLR has been a matter of debate since past three decades. Majority of the studies in the available literature fail to show any advantage provided by functional bracing. Our study results are consistent with the current literature. The prospective, randomized study comparing patients post ACLR with and without a functional brace fail to show any statistically significant difference at 6 months follow up. Despite the existing evidence that functional braces do not provide any advantage, the use of braces post ACLR is still in vogue in clinical practice. We hope that this study will help, albeit in a small way, to add to the body of literature already available on this topic and may help in future meta-analyses to formulate guidelines for use of braces post ACLR.

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