

A Study to Evaluate the Practical Results of ACL Restoration with the Use of a Quadrupled Hamstring Graft

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Abstract

Aim: The objective of the present study was to assess the functional outcome of anatomical reconstruction of ACL with quadrupled hamstring graft.**Methods:** The current research lasted for two years and included one hundred patients who received quadrupled hamstring grafts for anterior cruciate ligament restoration at the Orthopedics Department.**Results:** Patients ranged in age from 21 to 52. Age 18-25 (42%) had the most patients, followed by 26-29 (28%). Mean age was 29.2 years. The majority of our 100 patients were male (82%), with 18 (18%) female. Left knee injuries occurred in 16 individuals (15%) and right knee injuries in 85 (85%). RTA caused 70% of ACL injuries. Sports (17%) was next. Some patients (13%) were wounded by ordinary activities like slip-and-fall. 41% had instability and 29% had knee discomfort. 10% reported knee locking, 20% instability and knee discomfort. Diagnostic arthroscopy before ACL surgery indicates 35% medial and 12% lateral meniscal tears. In 8%, both menisci were damaged. 45 percent were isolated ACL tears. At 9 months, 80% of patients received outstanding scores, up from 56% at 3 months. 14% of patients had excellent scores at 9 months and 6% had fair scores. No patient scored poorly.**Conclusion:** Quadrupled hamstring graft ACL restoration improves clinical results. Hamstring grafts lessen donor site morbidity and anterior knee discomfort over time. Low graft rejection and failure improve subjective and objective functional outcomes.**Keywords:** Arthroscopic ACL reconstruction, hamstring graft, endobutton, quadrupled hamstring graft, lysholm and gillquist score.

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Introduction

When the anterior cruciate ligament (ACL), the knee's primary internal stabilizing ligament, is injured, the joint becomes very unstable. Extreme deceleration movements (such as a quick halt, pivot, change of direction, or leap) are a leading cause of anterior cruciate ligament (ACL) tears in athletics. Patients may be able to return to their normal activities for a few hours, but then develop severe local edema and joint effusion due to extensive hemarthrosis. ACL tears are still a prevalent orthopaedic condition, especially among young individuals. After an anterior cruciate ligament (ACL) injury, ligamento-plasty is the recommended course of therapy. Surgical surgery known as anterior cruciate ligament (ACL) repair involves replacing the injured ACL with a bone-patella tendon-bone (BTB) graft or, more often,

with soft tissues (semitendinosus - gracilis muscles, or ST-G). [1] Since most non-operative treatments for anterior cruciate ligament deficiencies have produced functionally unsatisfactory results, arthroscopic anterior cruciate ligament repair has continued to be the therapy of choice. [2] It is important to take meniscus and osteochondral injuries into account when repairing an ACL, since both injuries often occur together. Failing to do so may lead to degenerative knee alterations. [3] Anterior cruciate ligament (ACL) repair, which may lead to issues such as knee stiffness and soreness after surgery and a lengthy recovery time. Arthroscopic reconstruction of ACL has recently replaced open repair as the preferred method because to its reduced risk of complications and shorter recovery time. [4] Autologous tendon grafts

are recommended as a replacement for the damaged ligament in cases when ACL repair surgery is necessary. [5] The graft of choice, however, is still at odds with itself.

The clinical results of ACL restoration are affected by several variables, such as the graft type, fixation technique, graft site, and post-operative rehabilitation program. [6] However, the success or failure of arthroscopic ACL repair surgery is highly dependent on the skill of the operating surgeon. There are a lot of graft fixation methods described in the literature. Cortical, cancellous, and cortico-cancellous fixation are the three basic categories into which graft fixation techniques fall. The most well-known system that relies only on cortical support is the EndoButton®. An apparatus is positioned against the anterolateral cortex of the femur using the endobutton fixation technique (Smith & Nephew, Andover, MA, USA) to support the graft inside the femoral tunnel. [7]

The current research set out to evaluate the practical results of ACL restoration with the use of a quadrupled hamstring graft.

Materials and Methods

The present study was conducted in the Department of Orthopedics, Shree Narayan Medical Institute and Hospital, Saharsa, Bihar, India for the period of 2 years and 100 patients were included in the study who had undergone Anterior Cruciate Ligament reconstruction using quadrupled Hamstring graft.

Inclusion Criteria

1. Both genders above 18yrs of age.
2. Symptomatic unilateral ACL rupture
3. ACL injury associated with meniscus injury
4. Chondral lesion (type1&2).

Exclusion Criteria

1. ACL rupture associated with posterior cruciate ligament injury,
2. Lateral collateral ligament injury, previous ligament reconstruction,
3. Stage 3 & 4 chondral lesion and advanced osteoarthritis of knee,
4. Patient with history of concurrent fracture,
5. Patient with history of operation on either knee.

Under a combination of spinal and epidural anesthesia, the patient was placed supine on a typical operating table with their knee joint a short distance from the table's distal breakpoint after all pre-operative procedures were completed. To facilitate mobility during the treatment, a one-liter saline container is positioned under the damaged knee. The uninjured limb is supported by a cushioned surface. These tests are conducted while the patient is under anesthesia: ADT, PDT, LT, and

PST. It is the upper thigh that receives the tourniquet. Sterile aseptic precautions are then used to wrap the limb after scrubbing it from the foot all the way up to the tourniquet. Before making a cut in the skin, make sure the scope and monitor are well-lit. In order to identify any possible meniscal lesion, diagnostic arthroscopy was conducted. Diagnostic arthroscopy was performed prior to graft harvesting. When the knee is bent at 90 degrees, a viewing portal (anterolateral port) is created at the level of the inferior pole of the patella, just across from the patellar tendon, using a blade with 11 teeth. The establishment of the anteromedial (working) gateway follows the recording of all diseases. Meniscal tears and other related disorders are treated appropriately, such as loose body removal and partial or complete meniscectomy. A 3 cm incision is made on the medial side of the tibial tuberosity and a 4 cm one on the inferior aspect of the joint line. Dissection under the skin completed. The pes anserinus insertion was successfully completed and hemostasis was established.

The superior and inferior border of Sartorius tendon is palpated and gracilis and semitendinous tendon are identified 3-4 cm medial to tendinous insertion. A little incision is carefully created along the top edge of the gracilis tendon, while the medial collateral ligament that lies below is carefully shielded. By avoiding damage to the saphenous vein and nerve, enough exposure may be maintained by staying in the same plane and retracting. After locating the tendons, the right angle artery forceps gracilis are used to separate the semitendinous ligament from the fibrous tendon that attaches to the gastrocnemius and the semi membranous muscle. To remove adhesion, dissect the area up to the musculo-tendinous junction while keeping the knee in a 90-degree flexion. Persistent traction is delivered through the double loop knot at the end of the tendon using threads. The tendon's distal end is now liberated from its origin after a subperiosteal dissection. Thoroughly palpating the tendon to remove any adhesions or fibrous extension before stripping it with controlled traction is an important step in tendon release. Additionally, semitendinous tendon is removed in the same way. After the graft is harvested, it is immersed in a dish of salt water and any remaining muscle fibers are delicately peeled off. After that, the second graft is put on the graft master after being folded and quadrupled. Following a uniform sizing, the graft is looped to create a quadrupled graft, and finally, it is sewn together using a whip stitch pattern. We measured the graft's diameter and length.

The procedure involves inserting the scope via the anterolateral port and introducing the shaver through the anteromedial port. The joint has been

thoroughly examined for any signs of synovial fat or a torn ACL. Footprints on the femur and tibia are seen and noted.

Notchplasty is performed to access the medial side of the lateral femoral condyle. In cases of chronic ACL tears, when osteophytes invade the notch and cause the graft to become impinged upon while the knee is fully extended, this is an important consideration. Excess lateral notchplasty is stopped to avoid lateralization of the graft at the femoral attachment site; notchplasty is limited to the anterior intercondylar notch.

Femoral Tunnel Preparation: The native ACL footprint is marked keeping knee in 90 degrees of flexion and entry point is marked with aid of femoral offset aimer the marked point is drilled till the tip of guide wire pierces the lateral side of thigh. Now with drill bit the femoral tunnel is established by drilling both the cortices. Later the tunnel is reamed according to the diameter of the graft. The reaming is limited to 20mm from the far cortex.

Tibial Tunnel: With the aid of tibial guide, the tibial tunnel is established by keeping the knee in 70-90 degree flexion. The tibial guide placed 55-60 degree to tibial plateau to obtain accurate angle of native ACL. For stable fixation it should have a minimum of 20mm bone to secure the graft. With the rasp the tunnel is contoured and confirmed the outer portion tunnel is free of any soft tissues.

Graft Fixation: Graft is then passed through the femoral tunnel through arthroscopic guidance and the endobutton in flipped, cyclical tensioning of the graft is done by flexion and extension of the knee joint and then fixed with interference screw on the tibial side. The excess graft is trimmed and the stability of the knee is assessed by Lachman and pivot shift test. The incision is closed in layers.

Postoperative Management: Rehabilitation protocol initiated from POD 1. Dressing done on POD 2, 5, 7 and suture removed on 12th day. The patients were evaluated by ADT, PST & LT and Lysholm knee scoring scale.

Results

Table 1: Patient characteristics

Age in years	N %
18-25	42 (42%)
26-29	28 (28%)
30-34	8 (8%)
35-39	6 (6%)
40-44	6 (6%)
45-49	5 (5%)
50-54	5 (5%)
Gender	
Male	82 (82%)
Female	18 (18%)
Knee involved	
Right	85 (85%)
Left	15 (15%)
Cause	
RTA	70 (70%)
Sports Activities	17 (17%)
Daily Activities	13 (13%)

The youngest patient was 21 years and the oldest patient was 52 years old. The maximum number of patients were in the age group of 18-25 (42%) followed by the age group 26-29yrs (28%). The mean age was 29.2 yrs. In our series of 100 patients, 82 patients (82%) were males and 18 patients (18%) female, (Male Predominance). It may be because of the involvement of males in

outdoor activities like sports and motor vehicle accidents. Right knee was injured in 85 patients (85%) and left knee was injured in 16 patients (15%). Most of the ACL tears were caused by RTA (70%). Next common cause was sports activities (17%). Some patients (13%) got injured while doing daily activities like slip and fall.

Table 2: Distribution of cases based on presenting symptoms, based on associated injuries

Symptoms	N	%
Instability	41	41
Knee pain	29	29
Locking	10	10

Instability and knee pain	20	20
Associated injuries		
Isolated ACL tear	45	45
MM Tear	35	35
LM Tear	12	12
MM and LM tear	8	8

41% Patients were having instability and 29% cases presented with knee pain. 10% gave history of locking of knee, 20% presented with instability and knee pain. Diagnostic arthroscopy prior to ACL reconstruction confirms the medial meniscal tear in 35% cases and 12% lateral meniscal tear. Both the menisci were injured in 8%. 45% were isolated ACL injuries.

Table 3: Distribution of cases based on lysholm knee score

Lysholm knee score	Excellent	Good	Fair	Poor
3 month	56	32	12	0
6 month	70	22	8	0
9 month	80	14	6	0

At the 9th month follow up 80% of the patient had excellent score which were 56% at the 3rd month. 14% of patient had good score at the end of 9th month and 6% of patient had fair score. None of the patient had poor score.

Table 4: Postoperative complications

Postoperative complications	N	%
Pain	15	15
Infection	5	5
Laxative	5	5
Restricted Movements	7	7

15 patients (15%) had pain. Infection was present in 5 cases (5%), patients (5%) were having grade I laxity, 7 patients (7%) had flexion difficulty.

Discussion

One of the most effective surgical procedures in sports medicine, anterior cruciate reconstruction has emerged as a result of advancements in arthroscopic techniques, better technology, and more research. [8,9] With an estimated 200,000 cases annually in the US, injuries to the ACL rank highest among all ligamentous injuries. [10] Sports such as soccer, football, and skiing have been found to be high-risk sports and persons who engage in these sports are 10 times more likely to rupture the ACL when compared to other athletic activities. [11] Although ACL reconstruction is the gold standard for treating ACL tears, there is still some disagreement among experts as to when the best time is to perform the procedure. [12] Smith et al concluded from their systematic review that there were no differences in clinical outcomes between early (less than 3 weeks) and delayed (greater than 6 weeks) ACL reconstruction (ACLR); however, their conclusion is based on present literature that has limitations, such as non-randomization and lack of appropriate blinding. [13]

Prior to surgery, the authors recorded the patient's knee irritability (e.g., swelling, effusion, hyperthermia), range of motion (ROM), and any other injuries. When trying to figure out when surgery is best scheduled, the time of surgical

intervention is just one consideration among many. The decision of when to undergo ACLR is likely multifactorial and may include factors such as pre-operative status of the knee, family, school or work obligations, as well as mental preparation. More research is needed in order to identify a multifactorial objective algorithm that could be used to assist the surgeon and patient in determining when surgical interventions should occur in order to yield optimal clinical results. [14, 15]

The options of graft for ACL reconstruction comprehend Hamstring auto graft, bone patellar tendon graft, quadriceps graft, allograft and various synthetic graft. The hamstring and bone patellar tendon grafts are two of the most common types of grafts used in this context. The use of hamstring graft had credence as panacea for the problems with bone patellar tendon graft and has advantage in spite of having a reduced strength of the native ACL. There was a wide age range among the patients, from 21 to 52 years old. The maximum number of patients were in the age group of 18-25 (42%) followed by the age group 26-29yrs (28%). The mean age was 29.2 yrs. In our series of 100 patients, 82 patients (82%) were males and 18 patients (18%) female, (Male Predominance). Right knee was injured in 85 patients (85%) and left knee was injured in 16 patients (15%). Most of the ACL tears were caused by RTA (70%). Next common cause was sports activities (17%). Some patients (13%) got injured while doing daily activities like slip and fall. 41% Patients were having instability

and 29% cases presented with knee pain. 10% gave history of locking of knee, 20% presented with instability and knee pain. Diagnostic arthroscopy prior to ACL repair confirms the medial meniscal injury in 35% patients and 12% lateral meniscal tear. In 8% of cases, both menisci were damaged. 45% were isolated ACL injuries. Tetsuo Hagino et al. [16] observed that in acute group medial meniscus tear was discovered in 69.4%, lateral meniscus was 10.8% and both meniscus in 19.9%, but in chronic group medial meniscus 33.9%, lateral meniscus in 24.7% and both the meniscus in 41.4%. The research found that meniscal tear related with ACL damage is larger in chronic cases and medial meniscus primarily higher. In our research linked meniscal damage is determined to be 50%. 13 patients had isolated ACL damage, 11 pts had medial meniscus injury and 4 patients had lateral meniscus injury and 2 patients had both the meniscus affected. Commonly damaged was isolated ACL which was in commiserating with the other research. [17] In our research among the patients with meniscal damage 3 patients were treated by partial meniscectomy and meniscus repair was done for 6 patients and rest were handled conservatively. We have sought to avoid undergoing meniscectomy because it accelerates the degenerative changes the knee joint. So this is commensurate with the functional result of isolated ACL damage.

At the 9th month follow up 80% of the patient had good score which were 56% at the 3rd month. 14% of patient got excellent score at the end of 9th month and 6% of patient had fair score. None of the patient got bad score. The fixation of the graft has been proved to be the site of failure rather than the graft itself irrespective of the type of graft especially in the early rehabilitation phase when the graft integration has not taken place and the fixation is of little significance after 8 to 12 weeks when graft has integrated with the bone as proposed by Dawn T Gulick. [18] Pain affected 18 out of 15 individuals, or 15%. In five instances, or 5%, an infection was found; in seven cases, or 7%, flexion trouble was reported; and in five patients, or 5%, grade I laxity was seen. Patients included in our research did not report any notable patellofemoral discomfort. The research of Railey et al. is comparable to this. [19] An infection incidence of 0.3% was found by Williams et al. in their analysis of 2500 instances following arthroscopic ACL restoration. Two individuals in our research had superficial infections that went away after receiving intravenous antibiotics. [20] Pain, inflammation, edema, loss of range of motion, and muscle atrophy were all avoided with the help of the rehabilitation program that our study's participants followed after ACL reconstruction. [21]

Conclusion

Quadrupled hamstring graft ACL restoration improves clinical results. Hamstring grafts lessen donor site morbidity and anterior knee discomfort over time. Low graft rejection and failure improve subjective and objective functional outcomes. The Anterior Cruciate Ligament Reconstruction relies on the surgeon's arthroscopic skill, graft placement, and patient cooperation with therapy. Optimized outcomes need correct graft insertion and preparation in the tunnel. To better understand femoral fixation systems, long-term follow-up studies, radiological parameters like MRI, relevant subjective scores, and double-blind prospective trials comparing graft fixation methods are needed.

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