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Outcome of ACL reconstruction using 5 strand hamstring graft

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Abstract

Purpose: To determine the outcome of primary ACL reconstruction using 5-strand Hamstring autograft.
Methods: A retrospective study for 87 consecutive patients who underwent anterior cruciate ligament Reconstruction (ACLR) during a two-year time period. Hamstring tendons including Semitendinosus and Gracilis were harvested using closed Tendon stripper and 5-strand graft was prepared with a graft diameter of > 8.5 mm using no. 5 ethibond. Interference screw fixation was inserted at the tibial end and fixed loop endobutton was used at the femoral end. Follow ups were done at 1 month, 6 months and 1 year.

Results: The mean graft diameter was 9.14 mm. No patients had postoperative laxity at 1 month and 6 months. Only 3 patients had Lachman test positive at the end of 1 year but no complaints of buckling. No post ACL reconstruction infection were documented.

Conclusion: In primary ACL reconstruction, the 5-strand hamstring autograft achieves a good and stable clinical outcomes with a graft diameter of >8.5 mm. The 5-strand graft technique is therefore a useful means of increasing the graft diameter when faced with an undersized hamstring graft.

Keywords: ACL reconstruction, hamstring graft, 5 strand, arthroscopy

Introduction

Among most of the surgeons, Four-strand hamstring autograft is a most common choice for anterior cruciate ligament (ACL) reconstruction. Always a dilemma persists over the optimal graft choice for ACL reconstruction among which the use of hamstring autograft has been popular over recent years. Previously, central-third BPTB autograft was always favored because of its benefits of bone to bone tunnel healing and faster rehabilitation. However, BPTB harvest is known to be associated with significant morbidities, including chronic anterior knee pain, quadriceps weakness, patellar fracture and patellar ligament disruption. Due to which 4 strand Hamstring graft has gained popularity because of fewer complications. Several studies have suggested that these grafts produce functional results comparable to those of bone-patellar tendon-bone autografts^[1, 2]. A correlation was seen between graft cross-sectional area and maximum load to failure in Biomechanical testing^[3]. However, younger, smaller patients often yield smaller hamstring tendons^[4]. Leading to smaller final graft sizes. It has been seen that smaller graft size, has been associated with an increased rate of revision surgery^[5]. Several clinical studies have shown a reduced revision risk with an increased graft diameter^[6, 7]. 5 strand hamstring graft has been reported to increase the graft diameter by 1 to 2 mm^[8, 9].

The purpose of the study was to determine the clinical outcome of ACL Reconstruction using 5-strand Hamstring graft including both Semitendinosus and Gracilis in providing thicker graft and stable joint Post Surgery.

Materials and Methods

A retrospective study of 87 patients above the age of 18 years who has underwent primary Arthroscopic ACLR using 5-strand Hamstring graft was performed from Sept 2018 till May 2020 excluding patients who underwent simultaneous meniscus repairs or any other extraarticular procedures were excluded from the study. Patients who underwent previous knee surgery, previous history of joint infection, with co-morbidity conditions such as Diabetes

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Mellitus, immunocompromised individuals, patients who lost to follow up were also excluded from the study. A total of 115 patients had undergone ACL Reconstruction, in whom 28 patients were excluded from the study. All patients underwent arthroscopic ACLR by the same lead operating surgeon. Minimum of 6 months follow up and a maximum of 1 year follow up was done for each patient by the same lead surgeon.

Surgical Technique

Spinal anaesthesia was administered to all the patients. Patients leg was painted and draped under all aseptic conditions. The procedure was performed in supine position with lateral thigh post with exsanguination of the lower limb and under tourniquet control with the leg free. Standard anterolateral and anteromedial portal is taken and the intra-articular hematoma is evacuated. Following this, standard knee diagnostic arthroscopy is performed and all structures visualized and probed to assess the integrity. The torn anterior cruciate ligament is shaved off, preserving the tibial footprint. A three centimetre skin incision was made just medial to the tibial tubercle, the semitendinosus and gracilis tendons were identified with care to maximize tendon length, especially in the semitendinosus and harvested. A five-strand graft was prepared after tendons were cleaned on the preparation table. Semitendinosus tendon was tripled and Gracilis was doubled thus preparing a 5 strand graft using whipstitch technique. A minimum of 24 cm semitendinosus was required to attain a length of 8 cm of the graft. In case of longer graft we could manage to attain a minimum of 8.5 mm graft thickness. The graft was placed in normal saline soaked gauze for 10-15 minutes before graft insertion. Increasing the soakage time causes bulging of the graft. Meanwhile, the femoral and tibial drilling is performed according to the graft thickness at the tibial and femoral tunnel. The graft was tensioned, passed through the tunnels and fixation achieved using biodegradable screw on the tibial end and suspensory fixation on the femoral end in all the patients.

Postoperative Management

Post-operatively, the knee is immobilized in a long knee brace. Patients were given postoperative oral antibiotics for 5 days. Immediate protective weight bearing was initiated as tolerated using crutches/ walker. Active closed chain exercises were initiated in the first week, gradually achieving 90 degrees of flexion by the end of second post-operative week continuing till 4 weeks and increasing the range of motion of the knee thereafter. Patient returned to performing activities of daily living by the end of fourth post-operative week. Return to previous full-activities were achieved by the end of 5 months.

Results

A total of 87 patients with age group of 18- 45 years met the inclusion criteria and were included in the study. 71 patients were of young age ranging from 21- 35 years. Remaining 16 patients were of age ranging from 36- 45 years. 68 patients were male and 19 patients were female. 42 patients had twisting injury while playing Football in 31 patients, Basketball in 2 patients, Badminton in 5 patients and rest in other sports. 6 patients met with a road traffic accident, 29 patients had twisting injury at home remaining patients didn't recall the injury incident. All the patients were operated between 25 days and 220 days from the injury with a mean of 102.4 days. All the patients were diagnosed with isolated ACL injury through MRI imaging with all patients having

Lachman and Anterior Drawer test positive and Pivot test positive in 62 patients. Preoperatively 61 patients had full range of movements and remaining had knee flexion upto 125 degrees with extension lag of 10 degrees in 11 patients. 21 patients had left knee surgery and 66 patients had right knee surgery.

The type of graft employed in both the groups was five stranded hamstring graft. Graft size attained was a minimum of 8.5 mm thickness in all the surgeries. 8.5 mm in 9 patients because of shorter graft size including 4 patients with iatrogenic pre-cutting of semitendinosus during harvesting, 9 mm in 53 patients and 10 mm in 25 patients. The mean graft diameter was 9.14 mm. All the patients had stable joint post operatively with absent lachman test. No patients had postoperative laxity at 1 month and 6 months. Only 3 patients had Lachman test positive at the end of 1 year but no complaints of buckling. No post ACL reconstruction infection were documented. All the patients had good outcome in the terms of scoring system.

All patients had a full range of movement with no to minimal swelling of the knee with all patients returning to there previous physical activities.

Discussion

Insufficient and smaller graft diameter is always of concern when performing ACL reconstruction. The main challenge to this 5-strand technique is ensuring that each of the 3 strands of the semitendinosus has adequate tension. This construct can be equally tensioned with careful measurement and placement of whipstitches ^[10]. It was demonstrated that smaller hamstring size predictors include shorter height, younger age, and female gender ^[4]. Smaller hamstring autograft sizes yield smaller-diameter constructs, which ultimately lead to weaker ACL grafts. Hamner *et al.* ^[11] reported that these small grafts have a weaker ultimate failure load.

Magnussen *et al.* ^[12] showed in a study of 256 patients with hamstring autograft ACL reconstruction, 7.0% required revision at a mean of 14 months' follow-up. Decreased graft diameter and age were shown to be associated with increased revision rates. Grafts greater than 8 mm in diameter had a revision rate of 1.7%, 7.5- to 8-mm grafts had a revision rate of 6.5%, and grafts of 7 mm or less had a revision rate of 13.6%. When grafts of 8 mm or less were used in patients aged younger than 20 years, the revision rate rose to 16.5%. In another study Treme *et al.* ^[13] has demonstrated that patients with a weight less than 50 kg, height less than 140 cm, body mass index less than 18, and leg circumference less than 37 cm are at highest risk of a hamstring autograft diameter of less than 7 mm. Younger and more active patients are at highest risk of less than 7 mm hamstring autograft shown in some of the studies ^[12, 14]. Whenever graft size is of concern, this study shows 5-strand hamstring graft allows a larger final diameter ACL graft construct in a combination femoral cortical button and tibial interference screw construct.

Conclusion

The 5-strand graft technique is a useful means of increasing the graft diameter when faced with an undersized hamstring graft. This may translate to improved patient outcomes and reduced revision rates with faster rehabilitation and lower recurrence rates.

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