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Short term functional outcome following arthroscopic ACL reconstruction using a combination of quadruple hamstring tendon, adjustable cortical suspensory fixation device on femoral side and bio-screw on tibial side

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Abstract
BACKGROUND: The Anterior Cruciate ligament (ACL) is the most commonly injured ligament among the sports persons. The success of Anterior cruciate ligament (ACL) reconstruction requires ideal graft, reliable and rigid graft fixation and well planned rehabilitation protocol to bring them back to their pre injury state of function. Hamstring graft in place of Bone Patellar Tendon Bone Graft has revolutionized the ACL surgery all over the world with Good to Excellent functional outcomes with negligible anterior knee pain. Cortical suspensory fixation (CSF) devices have become an acceptable alternative to interference screws for Hamstring tendon grafts on Femoral side and a Bio-screw fixation on tibial side.
Aim: Short term Functional Outcome Following Arthroscopic ACL Reconstruction in Non-Athletic patients using a combination of Quadruple Hamstring Tendon, Adjustable Cortical Suspensory Fixation Device on Femoral side and Bio-Screw on tibial side.
Materials & methods: The retrospective data of 32 knees (31 patients), who have undergone ACL reconstruction between April 2011 to March 2019 using AM Portal with quadrupled Hamstring tendon graft, adjustable CSF Device on femoral side and Bio-absorbable interference screw on tibial side were included. All the patients were followed up to a minimum period of one year and maximum period of 2 years post ACL reconstruction. The knee function was assessed by using Tegner Lysholm knee scoring scale.
Results: In our study of 32 knees in 31 patients, the average age of the patients was 30.70 years. Good to excellant functional outcome was achieved in 94% of patients and fair functional outcome was present in 6% of patients by Tegner Lysholm knee score. There was significant improvement in Post ACL reconstruction mean score (89) from Pre-Operative mean score (49) using Tegner Lysholm knee scoring scale.
Conclusions: The short-term results of Arthroscopic ACL reconstruction with a combination of quadrupled Hamstring tendon graft, femoral adjustable CSF device and Bio-absorbable interference screw fixation on tibial side using AM Portal gives good to excellent functional outcome in Non-athletic patients. However, we recommend a larger cohort and longer study period to validate the results and conclude further.

Keywords: Anterior cruciate ligament, Quadruple Hamstring Tendon, Adjustable Cortical Suspensory Fixation (CSF), Bio-screw,), Tegner Lysholm Score, RTA (Return to Activity).

Introduction
Ruptures of the anterior cruciate ligament (ACL) are among the most common ligamentous injuries. There is scarcely any other ligament in the human body that has been the subject of more professional conferences and publications [1]. ACL is prone for frequent injury as it is the primary stabilizer of the knee joint and prevents it from anterior translation and counteracting rotational and valgus stresses. To mitigate the complications arising from injury to this ligament, it is necessary to reconstruct it.

Review of literature
Arthroscopic Anterior Cruciate Ligament (ACL) reconstruction is an established and widely

practiced procedure with good to excellent outcomes and low morbidity profile. The lower harvest morbidity, availability of a greater sectional area and preservation of extensor mechanism has made Hamstring grafts an attractive alternative to BTB [1, 2]. The quadruple hamstring graft has an ultimate tensile load as high as 4108 N and stiffness of 807 N, and nearly twice as stiff as 10 mm central BTB graft [2]. Femoral Tunneling using AM Portal has helped to place the graft in more anatomical position [3]. Of the various devices used to anchor the graft on the femoral side, cortical suspensory devices have the necessary biomechanical properties with regard to ultimate failure strength, displacement, and stiffness for initial fixation of soft tissue in the femoral tunnel for ACL reconstruction [4]. The aperture fixation of the graft using the interference screws on the tibial side, allows for early firm fixation and healing with tight bone-tendon interface [5]. Recent studies have shown that Bio-absorbable screws provide a fixation strength equal to that of metal screws [1].

The return to activity (RTA) following reconstruction surgery, depends on adequate patient education, occurs usually by 6 months to 9 months and most of them by 12 months [6]. This can be quantitatively assessed using functional scoring systems like IKDC and Tegner Lysholm Knee Scoring systems [7]. The Lysholm scale was designed by Lysholm and Gillquist in 1982. This was revised in 1985, adding knee locking [8]. Tegner score was developed to complement the Lysholm scale and it has 8 items and four grades [9, 10]. Grade A (Excellent): score > 90, Grade B (Good): score = 84 - 90, Grade C (Fair): score = 65 - 83 and Grade D (Poor): score < 65.

Objective of study

Short term Functional Outcome Following Arthroscopic ACL Reconstruction in Non-Athletic patients using a combination of Quadrupled Hamstring Tendon, Adjustable Cortical Suspensory Fixation Device on Femoral side and Bio-Screw on tibial side.

Materials & methods

The data was collected retrospectively, from the OP and IP Case files, of post ACL reconstruction patients, from Dr. SMCSI Medical college hospital in Karakonam and Rural Health Training centre in Kazhakutttam after Institutional statutory clearance and patient consent. The study included 32 knees of 31 patients, who underwent ACLR between April 2011 and April 2019. All patients were assessed clinically and diagnosis of ACL tear confirmed with MRI. One patient sustained ACL tear of contralateral knee during the follow up which was operated upon.

Inclusion criteria: 1. Age between 18 to 55years, 2. Isolated ACL tear patients or ACL reconstruction with meniscus tear Balancing done, 3. ACL reconstruction using Quadrupled Hamstring tendon graft, 4. ACL reconstruction using AM Portal for femoral Tunnel, 5. Adjustable CSF device fixation on femoral side, 6. Bio-Screw on tibial side, 7. Follow up period: minimum one year and maximum 2year.

Exclusion criteria: 1. ACL avulsion injuries, 2. ACL reconstruction with total meniscectomy / repair done, 3. Patients with multi-ligamentous tear / fractures / lower limb deformities, 4. All other types of graft / fixation methods, 5. Infection in the Knee joint. 6. Athletes

Operative procedure

All patients were operated by first author using standard technique under Spinal-epidural / General anaesthesia and tourniquet control. Semitendinosus +/- gracilis tendon from ipsilateral limb was harvested and quadrupled. Differential diameter femoral tunnel made through AM Portal. Tibial tunnel was made with the aid of standard ACL tunnel guide and the tunnel reamed sequentially to graft diameter. Quadrupled Hamstring tendon graft was looped on to an Adjustable CSF device and negotiated through the tibial tunnel and across the knee joint to the femoral tunnel. Once the Endobutton was flipped on the outer cortex of femur, the lead sutures were pulled gradually to seat the graft in the femoral tunnel, without slack by applying a firm downward pressure on the tibial side. Cycling of the knee was done to tension the graft. Then on the tibial side, the graft was fixed with Bio absorbable interference screw keeping the knee in 20 degree of flexion. Wound was closed without drain. Compression bandage and knee brace were applied post op.

Post operative period

Sutures were removed on the 14th post-operative day. The Patients were followed up at intervals of 2 weeks for one and half months. Followed by every 3rd week till the 3rd post op month. Then every 6th week till 12th post op month and with yearly follow up thereafter.

Standardized physiotherapy protocol was followed to suit our patients. During the follow-up visit, the patients were subjected to manual laxity testing, Lachman test, Anterior drawers tests at 6 months and Pivot shift test was done after 9 months. All the patients were evaluated Clinically and by Tegner Lysholm knee score.

Results

Out of the 32 cases, there were 22 males and 8 females. The average age of patients was 30.70 years, with youngest being a girl of 18 years and the oldest being a man of 50 years. 72% cases were below 35 years. The right knee was affected in 75%. The Mean follow-up was 20.6 months.

Return to activity was as early as 6 months in low demand patients and up to 12months in carpenters and dancers. Quadriceps wasting especially VMO wasting is a consistent feature among our patients especially among those with moderate physical activity in short term follow up.

Table 1: Functional outcome by tegner lysholm score

Grade	Tegner-Lysholm score
A (>90)	50% (16 cases)
B (84-90)	43.75% (14 cases)
C (65-83)	6.25% (02 cases)
D (<65)	Zero

The Tegner-Lysholm knee score applied showed a Good to Excellent result in > 90% of patients. Fair (Group C) results in 6% of patients. No patient had a poor result. The statistical analysis of the post ACL reconstruction mean of 89.41+/-5.44(SD) against the pre-operative Mean of 48.84 +/-5.96(SD) showed a p value <0.001* (p value <0.05 is significant). That means there is a statistically significant outcome by this technique.

Discussion

The objectives of ACL reconstruction surgery for an individual with ACL rupture are to (1) Restore knee function, (2) Restore psychological barriers to resuming activity

participation, (3) Prevent further knee injury and (4) Optimize long-term quality of life.

The functional outcome following ACL reconstruction is a widely studied subject and the results are dependent on technique (Femoral tunneling by Trans tibial vs AM portal), type of Graft (BPTB vs Hamstring), fixation Devices (IFS/ Fixed CSF device to Adjustable CSF Device and Suture discs) and rehabilitation protocol. However, majority have reported good to excellent results following ACL reconstruction either with BPTB graft or Hamstring graft [11].

The Good to excellent results of more than 90% cases in our study, can be attributed to (1.) The technique (AM Portal), we have adopted helped us to position the femoral tunnel more horizontally, (2.) The choice of quadrupled Hamstring graft, (3.) Adjustable CSF device and (4.) Bio-screw in addition to being operated by single surgeon.

Table 2: We compared our results with the results of studies by Riley J Williams [12], Fareed *et al.* [13] and William PH *et al.* [14].

Author & Publisher	Graft and Technique	Sample size	Period (Months)	Study design	Results
Riley J Williams 3rd *et al.* Am JBJS 2005 [12]	Four Strand Hamstring Graft	85 Knees	28	Retrospective	Mean Lysholm score improved from 55 to 91
Fareed H *et al.* JBJS 2003 [13]	Hamstring Graft	25 Knees	25.4	Retrospective	96% Satisfactory results
William P H Charlton *et al.* Am J Sports medicine 2003 [14]	Quadrupled Hamstring Graft and Bio-screw	37 knees (36 Patients)	30.2	Retrospective	Mean Lysholm score was 91
Present Study	Quadrupled Hamstring Graft, Adjustable CSF device, Bio-screw & AM Portal.	32 Knees (31 Patients)	20.5	Retrospective	Mean Tegner Lysholm score improved to 89 against Pre op Mean of 48.

Conclusion

We conclude that the autologous quadrupled Hamstring tendon graft, adjustable CSF Device and Bio-screw using AM Portal for Femoral Tunnel is a good combination for ACL reconstruction in Non-Athletic Patients with uniform results (p value < 0.001*). Patients occupation / profession play a significant role the in their return to activity and outcome satisfaction. We recommend, midterm / long term follow-up of these patients and also in a larger cohort.

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