

Modified technique of ACLR with Dual Tibial Fixation Octuple Hamstring Graft: A Study of 50 Cases

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ABSTRACT

Background: Anterior cruciate ligament reconstruction (ACLR) is commonly performed in symptomatic patients with ACL tears, particularly in individuals involved in sports and physically demanding activities. Secure graft fixation and maintenance of appropriate graft tension are essential for restoring knee stability and reducing the risk of postoperative laxity and graft failure. Tibial fixation remains an important component of ACL reconstruction because inadequate fixation or loss of graft tension may contribute to residual instability. **Objective:** To describe a simple, cost-effective technique of dual tibial fixation using a suture disc washer in ACL reconstruction with a hamstring graft, with emphasis on maintaining graft tension and achieving secure tibial fixation. **Technique:** The technique utilizes a suspensory femoral fixation device and dual tibial fixation with a 2-hole conical suture disc washer. Following arthroscopic ACL reconstruction and femoral fixation, the graft is tensioned through repeated knee flexion-extension cycles. Tibial fixation is subsequently performed at approximately 30° of knee flexion by securing the graft sutures to the suture disc washer with multiple knots. The suture disc provides additional fixation at the tibial tunnel aperture and facilitates maintenance of graft tension. **Results:** The technique was used in 50 patients undergoing ACL reconstruction. The procedure provided an additional point of tibial fixation and allowed controlled tensioning of the graft during tibial fixation. The suture disc also covered the tibial tunnel aperture and the fixation construct, potentially reducing direct prominence of the fixation material beneath the skin. **Conclusion:** The described dual tibial fixation technique is a simple and cost-effective method for securing the ACL graft while maintaining graft tension. The use of a suture disc washer provides additional tibial fixation and may be particularly useful when secure graft fixation and protection of the tibial tunnel aperture are desired. Further comparative studies with larger patient populations and objective clinical and biomechanical assessment are required to establish its effectiveness.

Keywords: Anterior cruciate ligament reconstruction; ACL tear; hamstring graft; tibial fixation; suture disc; graft tension; arthroscopy.

INTRODUCTION

The anterior cruciate ligament (ACL) is one of the principal stabilizing structures of the knee and plays an important role in controlling anterior translation and rotational movement of the tibia relative to the femur. ACL injuries are frequently associated with sports-related activities, particularly those involving sudden acceleration, deceleration, pivoting, or rapid changes in direction. Disruption of the ACL may result in recurrent knee instability, secondary meniscal injury, cartilage damage, and progressive degenerative changes of the knee joint [1].

ACLR reconstruction (ACLR) is one of the most commonly performed arthroscopic procedures for

symptomatic ACL tears [2]. The success of ACL reconstruction depends on several factors, including appropriate patient selection, graft choice, accurate tunnel placement, graft preparation, fixation method, and appropriate graft tension during fixation [4–9].

Graft fixation is particularly important because inadequate fixation or loss of graft tension may result in residual laxity and postoperative instability. Intraoperative residual laxity of the reconstructed ligament may compromise restoration of normal knee kinematics and potentially contribute to graft failure. Maintaining appropriate graft tension during fixation is therefore an important step in achieving a stable reconstruction [10,11].

Several techniques and devices have been described to optimize graft tension and fixation. Adjustable-loop and device-assisted fixation systems allow controlled tensioning of the graft and may facilitate retensioning before final fixation [4,11,13]. The angle of knee flexion during graft fixation may also influence postoperative knee stability and graft behavior [7].

In conventional ACL reconstruction, tibial fixation is commonly achieved using an interference screw or other fixation devices. However, additional fixation may be desirable in selected situations to improve the security of the graft construct. The use of a suture disc washer provides an additional fixation point at the tibial tunnel aperture and permits multiple sutures to be secured outside the tunnel.

In the present technique, a 2-hole conical suture disc washer is used in combination with the tibial fixation construct to provide dual tibial fixation. The technique is intended to provide secure fixation while allowing the surgeon to optimize graft tension before tying the final knots. The suture disc also covers the tibial tunnel aperture and fixation construct, thereby reducing the prominence of the fixation material at the tunnel mouth. The purpose of this study is to describe a modified technique of ACL reconstruction using hamstring grafts with dual tibial fixation using a suture disc washer and to present the experience of its use in 50 cases.

PREOPERATIVE EVALUATION

The diagnosis of an ACL injury is based on a detailed history, physical examination, and appropriate imaging. The evaluation should begin with a complete history of the mechanism of injury, onset and duration of

symptoms, functional limitations, and episodes of instability.

ACL injuries commonly occur following contact or non-contact pivoting mechanisms, particularly during sudden acceleration, deceleration, or changes in direction.

Acute ACL Injury

Patients with an acute ACL injury may present with pain, swelling, difficulty walking, limping, or inability to bear weight. Some patients may experience difficulty achieving full knee extension or flexion because of pain and joint effusion. A sensation of strain or instability may also be reported.

Chronic ACL Insufficiency

Patients with chronic ACL insufficiency commonly present with recurrent episodes of instability, a giving-way sensation, or difficulty during pivoting activities. Patients may remain able to walk normally but may experience recurrent episodes of instability, pain, or intermittent joint effusion.

Chronic ACL deficiency may be associated with secondary meniscal or articular cartilage injuries. Therefore, symptomatic patients should be evaluated for associated intra-articular pathology and managed accordingly.

Imaging

Anteroposterior and lateral radiographs of the knee are obtained as part of the initial assessment. In the described cases, radiographs were generally unremarkable. Magnetic resonance imaging (MRI) was used to confirm the diagnosis of ACL injury and to evaluate associated intra-articular pathology.

Figure 1. Preoperative imaging demonstrating ACL injury.



SURGICAL TECHNIQUE

Patient Setup

After spinal anesthesia, knee stability is assessed using the Lachman and pivot-shift tests. Arthroscopic ACL reconstruction is performed using a transportal technique for femoral tunnel preparation.

The implants used in the described technique include a fixed-loop EndoButton for femoral fixation and a 2-hole conical suture disc washer for additional tibial fixation.

Patient Position

The patient is placed in the supine position on the operating table following spinal anesthesia.

A lateral support post is positioned at the mid-thigh level to stabilize the limb during knee flexion. A foot support is placed on the operating table to maintain approximately 90° of knee flexion when required.

A pneumatic tourniquet is applied at the thigh level according to the surgeon's standard operative protocol.

ARTHROSCOPIC PORTAL PLACEMENT

Standard anterolateral and anteromedial portals are established, with an accessory anteromedial portal used when required for transportal femoral tunnel preparation.

Figure 2. Preparation of the hamstring graft.



FEMORAL TUNNEL PREPARATION

Transportal femoral tunnel drilling is performed through an accessory low anteromedial portal.

The knee is hyperflexed beyond 120° to facilitate appropriate femoral tunnel positioning. A guidewire is introduced at the anatomical femoral ACL footprint.

A 4.5-mm femoral reamer is passed over the guidewire and used to create the femoral tunnel. The tunnel depth is measured to ensure appropriate graft placement.

The femoral fixation device is prepared according to the dimensions of the graft and tunnel.

TIBIAL TUNNEL PREPARATION

The tibial tunnel is prepared using an ACL tibial aiming guide set at approximately 55° with the knee positioned at approximately 90° of flexion.

Diagnostic arthroscopy is initially performed to confirm ACL rupture and to assess the medial and lateral compartments for associated meniscal, chondral, or other intra-articular pathology.

The femoral and tibial ACL footprints are identified before tunnel preparation.

ACL GRAFT HARVEST AND PREPARATION

The semitendinosus tendon is harvested through a small longitudinal incision overlying the pes anserinus.

The harvested semitendinosus tendon is prepared on the back table according to the planned graft configuration. In the described technique, a quadrupled semitendinosus graft is prepared using No. 5 suture.

A minimum graft diameter of approximately 8–9 mm is considered desirable. When the graft diameter is less than 8 mm, the gracilis tendon is added to increase the graft size.

The prepared graft length is approximately 6.5–7 cm, according to the dimensions of the individual graft construct.

Care is taken to ensure adequate tunnel length. In the described technique, a tibial tunnel length greater than 35 mm is preferred to allow adequate graft passage and fixation.

The anterior horn of the lateral meniscus and the tibial eminence are used as anatomical references for positioning the tibial tunnel.

After tunnel preparation, the tibial tunnel aperture is cleared of soft tissue to facilitate graft passage and subsequent fixation.

GRAFT PASSAGE AND FEMORAL FIXATION

A wire loop is passed through the femoral and tibial tunnels.

The prepared ACL graft attached to the EndoButton fixation device is passed through the tunnels using the wire loop.

The graft is marked approximately 2 cm from the femoral side to assist in confirming appropriate graft seating within the femoral tunnel.

The EndoButton is then flipped over the lateral femoral cortex to achieve suspensory femoral fixation.

After femoral fixation, multiple knee flexion-extension cycles are performed to remove slack from the graft and sutures and to allow the graft to settle within the tunnels.

DUAL TIBIAL FIXATION WITH SUTURE DISC

Following femoral fixation and graft cycling, the tibial side is prepared for fixation.

The graft is tensioned appropriately, and the knee is positioned at approximately 30° of flexion.

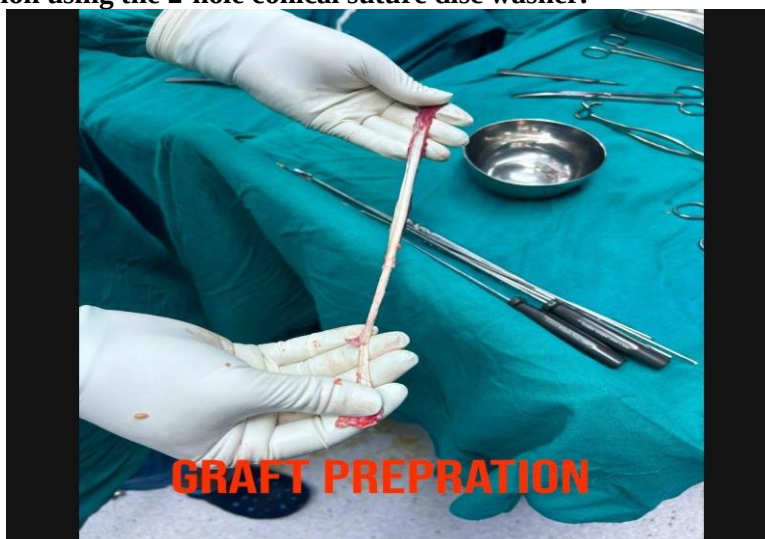
A 2-hole conical suture disc washer is positioned over the tibial tunnel aperture.

The No. 5 Ethibond sutures attached to the graft are passed through the holes of the suture disc washer and secured using multiple knots.

This provides an additional point of fixation at the tibial tunnel aperture and allows the surgeon to maintain appropriate graft tension during final fixation.

The suture disc also covers the tibial tunnel aperture and the fixation construct, reducing direct prominence of the fixation material at the skin surface.

Figure 3. Tibial graft fixation using the 2-hole conical suture disc washer.



FINAL ARTHROSCOPIC ASSESSMENT

After completion of fixation, the knee is examined arthroscopically.

Graft position and tension are assessed, and the reconstructed ACL is evaluated throughout the range of motion to ensure satisfactory positioning and absence of obvious impingement.

The Lachman test is subsequently performed to assess anterior knee stability.

POSTOPERATIVE REHABILITATION

Quadriceps-strengthening exercises are initiated immediately after surgery according to the postoperative rehabilitation protocol.

Partial weight bearing is permitted from the second postoperative day, followed by progression to full weight bearing as tolerated.

Knee range of motion is gradually increased. A maximum of approximately 90° of knee flexion is advised during the first 24–48 hours according to the described protocol.

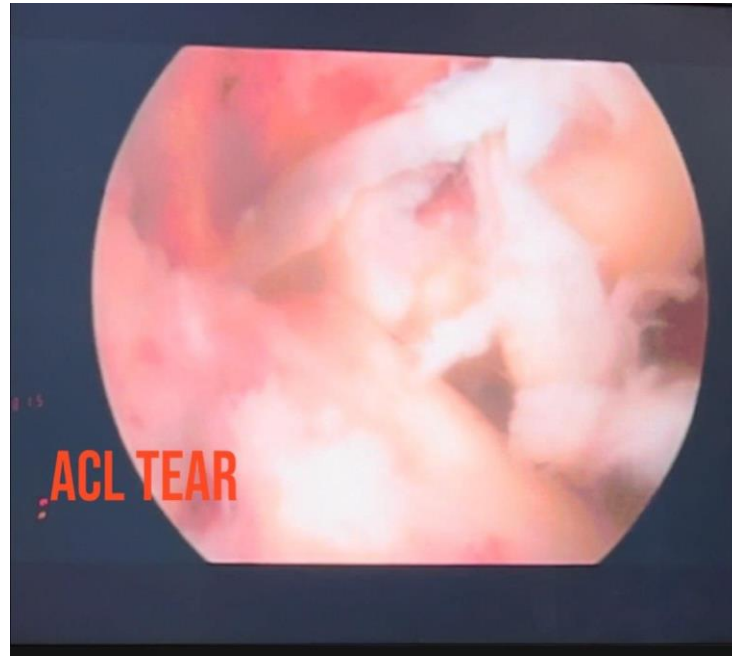
Stationary cycling and proprioceptive exercises are introduced during subsequent rehabilitation. Jogging is permitted from approximately 3 months postoperatively when clinically appropriate.

Return to competitive sports is generally considered between 6 and 9 months after surgery, depending on clinical recovery, knee stability, muscle strength, functional testing, and sport-specific requirements.

POSTOPERATIVE RADIOGRAPHIC ASSESSMENT

Postoperative anteroposterior and lateral radiographs are obtained to assess the position of the fixation devices and the reconstructed tunnels.

Figure 4. Postoperative radiographs demonstrating the fixation construct.



FINAL EXAMINATION AND POSTOPERATIVE CARE

At the completion of the procedure, the Lachman test is performed to assess knee stability.

Graft tension is assessed arthroscopically using a probe. The surgical wounds are irrigated and closed using standard techniques.

The knee is placed in a functional brace locked in extension.

A long knee brace is used for approximately 2 weeks postoperatively, followed by a hinged knee brace for an additional 4 weeks according to the described rehabilitation protocol.



Post Op. X-ray

DISCUSSION

The present technique describes a modified method of tibial fixation during ACL reconstruction using a 2-hole conical suture disc washer to provide additional fixation and facilitate maintenance of graft tension.

Adequate graft tension and secure fixation are important components of successful ACL reconstruction. Loss of graft tension or inadequate fixation may contribute to residual laxity and postoperative instability [10,11].

One of the principal advantages of the described technique is the ability to provide an additional point of tibial fixation outside the tibial tunnel. The suture disc allows multiple sutures to be secured and may therefore supplement the primary fixation construct.

Another potential advantage is the ability to retension the graft before final knot tying. Following femoral fixation, repeated knee flexion-extension cycles are performed to remove slack from the graft and sutures. Final tibial fixation is then performed with the knee positioned at approximately 30° of flexion.

The suture disc also covers the tibial tunnel aperture and the fixation construct. This may reduce the prominence of the fixation material at the tibial tunnel mouth and potentially improve soft-tissue coverage.

The technique uses a relatively simple fixation construct and does not require a complex additional fixation device. This may make the technique useful in settings where a simple and cost-effective method of supplementary tibial fixation is desired.

However, the present description represents the experience of the technique in 50 cases, and the supplied manuscript does not provide sufficient comparative clinical, radiological, or biomechanical data to determine whether the technique provides superior outcomes compared with conventional tibial fixation methods.

Future prospective comparative studies should evaluate objective knee stability, patient-reported functional outcomes, graft failure, revision rates, tunnel-related complications, and long-term clinical outcomes.

STRENGTHS OF THE TECHNIQUE

- Provides an additional point of tibial fixation.
- Allows graft tension to be optimized before final knot tying.
- Uses a relatively simple fixation construct.
- The suture disc covers the tibial tunnel aperture and fixation construct.
- May reduce prominence of the fixation material at the tibial tunnel mouth.
- Can be performed using commonly available surgical materials.

LIMITATIONS

The present study has several limitations. The manuscript does not provide a comparative control group, limiting direct comparison with conventional tibial fixation techniques. Detailed patient-reported functional scores, objective stability measurements, and long-term follow-up data are also not provided. In addition, the biomechanical strength and clinical superiority of the dual fixation construct cannot be established from the available data. Larger prospective comparative studies with longer follow-up are required

to evaluate graft survival, postoperative stability, complications, and functional outcomes.

FUTURE DIRECTIONS

Future studies should compare this dual tibial fixation technique with conventional tibial fixation methods in prospective controlled cohorts. Objective assessment using Lachman testing, instrumented laxity measurements, functional knee scores, return-to-sport rates, graft failure rates, and revision surgery should be incorporated. Biomechanical studies may also help determine the contribution of the suture disc to overall graft fixation strength and resistance to cyclic loading.

CONCLUSION

The described modified ACL reconstruction technique combines suspensory femoral fixation with additional tibial fixation using a 2-hole conical suture disc washer. The technique provides an additional fixation point, facilitates maintenance of graft tension during tibial fixation, and covers the tibial tunnel aperture and fixation construct. It is a relatively simple and cost-effective technique; however, comparative clinical and biomechanical studies are required to determine its effectiveness and potential advantages over conventional tibial fixation methods.

DECLARATIONS

Ethics Approval and Consent to Participate

Ethical approval was obtained from the appropriate institutional ethics committee before commencement of the study. Written informed consent was obtained from the participants included in the study.

Note: Ethics committee name and approval number were not provided in the supplied manuscript and should be inserted if available.

Consent for Publication

Not applicable.

Availability of Data and Materials

The data generated and/or analyzed during the present study are available from the corresponding author on reasonable request.

Competing Interests

The author declares that there are no competing interests.

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Authors' Contributions

The author conceived and designed the study, performed the surgical procedures, contributed to data collection and interpretation, and prepared and approved the final manuscript.

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AI Use Disclosure

Artificial intelligence tools were used during the preparation of this manuscript for language editing, grammar correction, restructuring, and improvement of clarity and readability. The author reviewed and verified the AI-assisted content and remains fully responsible for the accuracy, integrity, and originality of the manuscript.

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