Short Communication
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# Alternative for tibial fixation in Patellar Tendon ACL Reconstruction

## Abstract

**Objective:** Introduce an alternative for tibial fixation in Anterior Cruciate Ligament (ACL) with Patellar Tendon, in cases with long graft and a bone plug that stay outside the tibial tunnel and evaluate its results.

**Methods**: From 2010 to 2020, 12 patients were submitted to a ACL reconstruction with a Bone-Patellar Tendon-Bone (BTB) graft using the anatomic technique. Starting with the femoral fixation, if the BTB graft is too long where the bone plug is outside the tibial tunnel, instead of cutting the graft, a cavity is dig in the tibia, distal to the tunnel entrance, and the bone plug is kept inside using a bone clip, followed by an interference screw in the tibial tunnel. With a minimum follow-up of 24 months, the patients knee stability was evaluated pre and post operatively.

**Results:** The mean follow up was 29 months. All patients had a stable knee post operatively, with no complications.

**Conclusion:** The ACL reconstruction using the proposed technique shown excellent results in short and long term, regarding knee stability. We believe that the proposed method is better than just cutting out the bone plug.

**Keywords**: Anterior cruciate ligament, patellar tendon, reconstruction, graft

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## Introduction

The ACL originates in the intercondylar crest of the femur lateral condyle and insert in the antero-medial tibial plateau in the anterior intercondylar region. It follows an oblique path with a mean sagittal angle of 54-55,5 degrees (measured between the ACL and the tibial plateau).[1] The ACL injury is the most common knee injury, with 129.000 to 200.000 reconstructions per year in the US and 400.000 worldwide. [2]

The use of the central portion of the patellar tendon to reconstruct an ACL was described by Jones, to have a more physiological procedure than those used before.[3] The bone – tendon – bone graft (BTB) is still considered the gold standard in treatment of ACL injuries, despite the flexor tendon being more used nowadays. The BTB advantages are more rigidity and resistance to failure, and its revascularization capacity.[4]

Identifying a patient with an ACL injury can be achieved by trauma history and physical examination. Patients usually describe a sudden deacceleration with or without external contact during cutting or pivoting maneuvers. Patients sometimes describe an audible snapping sound presenting pain and joint swelling. Physical examination with a Lachmann test and anterior drawer using the contralateral knee for comparison.[5] The Pivot Shift is considered a pathognomonic test but may be difficult to perform in the acute phase. A recent metanalysis has shown the Lachman Teste to be more specific (94%) and Pivot Shift more sensitive (98%).[6]

The use of modern arthroscopic techniques and an aggressive rehabilitation protocol can have positive outcomes despite the time to surgery. The criterial for positive ACL reconstruction are full ROM recovery, muscular strength and return to previous level of sporting activities.[7,8]

The objective of this study is to describe a variation on the tibial fixation technique for ACL reconstruction with patellar tendon graft, where the graft hangs outside the tibial tunnel with enough evidence to withstand the pulling strengths and stabilize the knee.

## Methods

From 2010 to 2020, 12 patients with ACL ruptures were operated using the BTB technique. After the femoral fixation with a interference screw on the anatomic position, if the distal bone plug was placed outside of the tibial tunnel, we made a small and quick modification that seems more stable to us than removing the bone plug from the graft. With a minimum follow-up of 24 months, the patients were evaluated using the Lachman and pivot shift test and analyzed with MRI scan. All patients were submitted to the same rehabilitation program.

## Surgical technique

All procedures were performed under regional anesthesia. Patients lay supine on the operating table, with a pneumatic cuff on the proximal tight. After the removal of the Patellar Tendon graft by a 4-5 cm incision on the anterior knee, the arthroscopic portals were used to articular debridement and cleaning of the remains of the ACL. Using this approach, the tibial and the femoral tunnels were drilled in the anatomic position using drills and external guides.

Two holes were drilled in each bone plug of the graft for the passage of Ethibond® wire #5. The graft is then guided inside the tunnels and its femoral end is locked in place with an absorbable interference screw. After the femoral fixation, we test it by pulling the graft. The knee is placed in extension. In cases where the graft is too long, where 2/3 of the tibial bone plug is outside of the tunnel (Figure 1), instead of cutting the graft, a cavity is dig in the tibia, distal to the tunnel entrance (Figure 2). The bone plug is placed inside the cavity with cancellous bone contact, and using an agraffe, it's held in place (Figure 3), followed by an interference screw in the tibial tunnel (Figure 4 & 5). The stability and ROM are tested intra operatively

and wounds closed, dressing and removal of the cuff. Weight bearing is allowed on the first day post op and an advanced rehabilitation protocol is ensued.

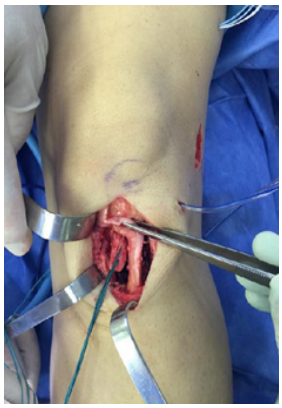

**Figure 1** The graft is too long.

**Figure 2** A cavity is dig in the tibia, distal to the tunnel entrance.

**Figure 3** The bone plug is placed inside the cavity with cancellous bone contact, and using a agraffe, it's held in place.

## Discussion

The Graft choice for ACL reconstruction remains a controversial topic. In a prospective controlled randomized study, a BTB vs hamstring graft with a 3 year follow up, the objective results of replacing the ACL for a BTB graft were superiors to the double *gracilis semitendinous* regarding knee laxity, pivot shift and knee muscle strength. However, comparable results regarding patient satisfaction, performance levels and knee function. Different fixation techniques and the fact that only two strains of the bundle of the hamstring reconstruction were used may have contributed for a worst result.[9]

**Figure 4** An interference screw in the tibial tunnel completes the fixation.

**Figure 5** Final aspect of fixation.

It's known for a long time that the ACL provides more than a simple mechanical stabilization for the knee. A recent study comparing functional brain MRI observed a rearrangement of the central nervous system in many motor areas of patients with a chronically deficient ACL against a control group.[10] It is important to understand the graft healing process to safely manage the reconstructed ACL rehabilitation. This usually takes four phases: acute inflammatory, revascularization, cellular proliferation and finally, collagen remodeling.[11] This is called ligamentization.[12] For immediate knee mobilization post operatively, a strong graft fixation is needed to withstand the daily forces of walking and common daily activities, which were estimated to be around 450N.[13,14] We concluded that this fixation technique of the patellar graft has demonstrated to be a viable alternative for a redundant graft.

A usual practice among knee surgeons on the face of a longer graft, is to simply extirpate the bone plug and just use a interference screw for distal fixation of the graft. But we propose that using the bone plug may improve the quality of that. Studies comparing the placing of a redundant graft, removing the bone plug or using a bone clip as described were not found in the current literature.

## Conclusion

A way to deal with a long BTB graft and a bone plug located outside the tibial tunnel in the ACL reconstruction, is to put the bone plug in a crease created immediately distal to the tibial tunnel entrance, using a bone clip. This technique has shown satisfactory results in short- and long-term follow-up on all twelve patients evaluated. With excellent results when evaluated for stability and bone integration by an MRI.

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## Conflicts of interest

The authors declare no conflicts of interest.

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