

# DARTHROSCOPIC DOUBLE- BUNDLE RECONSTRUCTION OF ANTERIOR CRUCIATE LIGAMENT USING HAMSTRING TENDON GRAFTS - FIXATION WITH TWO INTERFERENCE SCREWS

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## ABSTRACT

Surgical procedures for double-bundle reconstruction of anterior cruciate ligament, which currently use semitendinous and gracilis tendon grafts, have been described in the last decade. Most of the techniques utilize twice the hardware used in single-bundle reconstructions. We report an original anterior cruciate ligament double-bundle reconstruction technique using semitendinous and gracilis

tendon grafts, maintaining their tibial bone insertions with two tibial and two femoral tunnels. A simplified and precise outside-in femoral drilling technique is utilized, and the graft fixation is made utilizing only two interference screws.

**Keywords** – *Anterior cruciate ligament; Knee injuries; Knee*

## INTRODUCTION

Arthroscopic reconstruction of the anterior cruciate ligament (ACL) is one of the most frequently performed surgical procedures in orthopedic practice. Numerous studies have been conducted in order to review the surgical techniques, types of graft, fixation methods, postoperative rehabilitation and, above all, failure of the procedure. Although most of the results of surgical treatment are satisfactory, there is still a 15% residual pivot-shift rate in the literature<sup>(1)</sup>. With better knowledge of the anatomy and function of the ACL, various surgical reconstruction techniques have been developed. Double-bundle ACL reconstruction is attractive because it seeks to reproduce the anatomy and function of the ACL.

Since 1999, several surgeons have performed anatomical double-bundle ACL reconstruction<sup>(2,3)</sup>. The lo-

cation of the femoral origin of the posterolateral bundle (PL) has been a subject of debate. The location of the PL bundle (with the knee in 90° of flexion) is distal and posterior to the anteromedial bundle (AM)<sup>(3-6)</sup>. From the biomechanical point of view, recent studies have shown that double-bundle ACL reconstruction can improve normal knee kinematics<sup>(7)</sup>. These findings are supported by prospective clinical studies, which show a reduction in the anterior drawer and better control of rotation in double-bundle ACL reconstruction compared with single-bundle reconstruction<sup>(4)</sup>. The vast majority of surgical procedures using the double-bundle use semitendinosus and gracilis (STG) tendon grafts. All procedures, however, use twice as much synthesis material for graft fixation in ACL reconstruction compared with the single-bundle. The goal of this technique is to reconstruct the anterior

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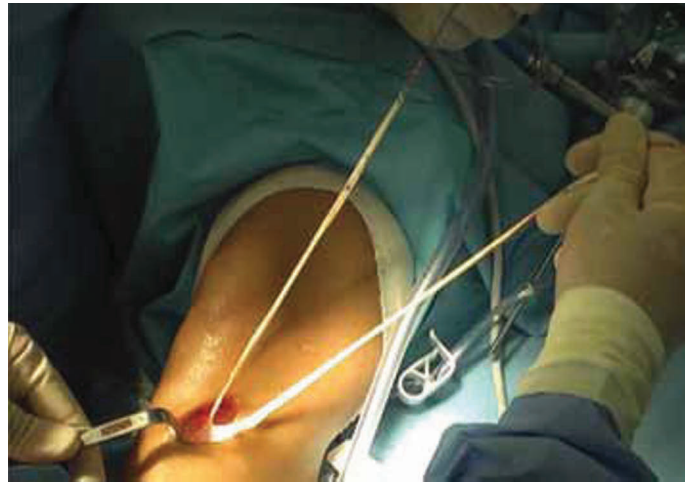
We declare no conflict of interest in this article

cruciate ligament with the double-bundle using semitendinosus and gracilis tendon grafts, fixing it with just two interference screws, as is done in ACL reconstruction with a single-bundle.

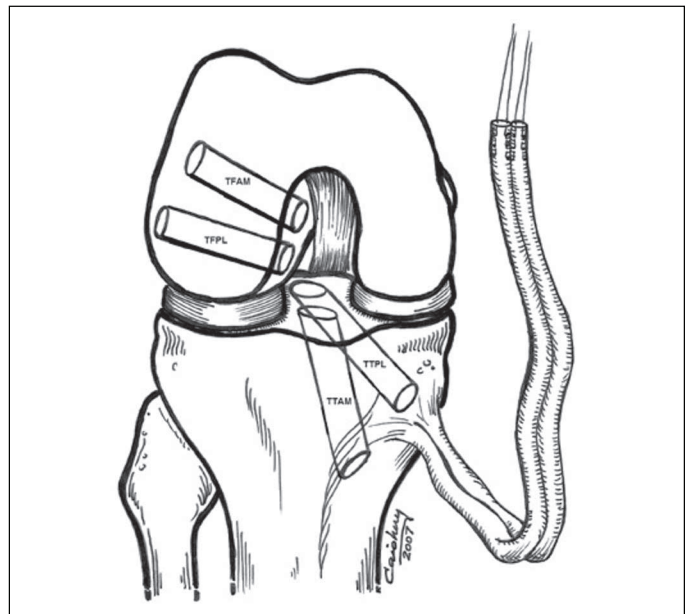
## TECHNIQUE

An incision of about 4 cm long is made longitudinally in the anteromedial portion of the proximal tibia. We dissect the tendons of the semitendinosus and gracilis muscles keeping the tibial insertion (Figure 1). Using the arthroscopy, anteromedial (AM) and posterolateral (PL) tibial tunnels are drilled. First, AM tibial tunnel was made in the usual manner with an exit in the anteromedial region of the tibial insertion of the ACL. This tunnel has a more sagittal orientation ( $20^\circ$  from the sagittal plane and  $50^\circ$  from the horizontal plane). The PL tibial tunnel originates anterior to the tibial insertion of the superficial medial collateral ligament and ends at the posterolateral aspect of the tibial insertion of the ACL. This tunnel is situated in a more coronal plane ( $45^\circ$  to the horizontal and sagittal plane). Both tibial tunnels are drilled with a 6-mm drill (Figures 2 and 3). Then, we made the AM and PL femoral tunnels from the outside in with the aid of an adequate femoral guide. The AM femoral guide wire was positioned 5 mm anterior to the posterior cortex of the lateral femoral condyle at 9 o'clock in the right knee or at 3 o'clock in the left knee (Figure 4). The PL femoral guide wire is positioned 6 mm distally and  $30^\circ$  posterior to the AM femoral guide wire (Figure 5). The femoral tunnels are then drilled with a 6-mm drill from the outside in (Figures 2 and 6).

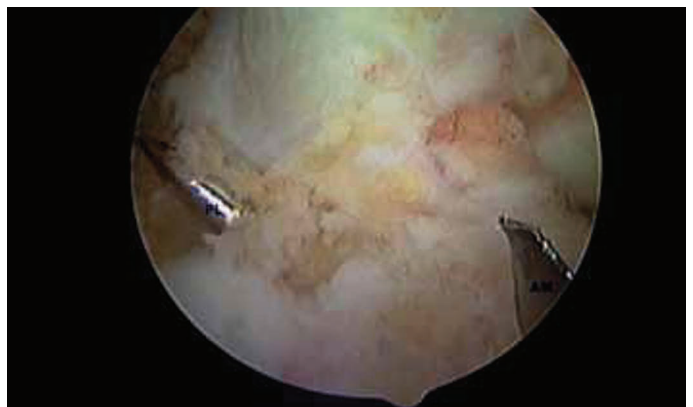
With the help of a tendon-passing device, the graft is introduced into the joint through the PL tibial tunnel and exteriorized in the lateral knee through the PL femoral tunnel. The graft is tensioned and fixed from the outside in with an interference screw (metallic, or bioabsorbable for soft tissues) in the posterolateral femoral tunnel with the knee in  $15^\circ$  of extension (Figures 7 and 8). The remainder of the graft is reintroduced into the joint by the AM femoral tunnel, and exteriorized through the AM tibial tunnel. Finally, the graft is tensioned and fixed with the knee flexed at  $50^\circ$  (Figures 9, 10 and 11). The small femoral and tibial incisions are closed in layers.



**Figure 1** – Flexor tendons of the semitendinosus and gracilis muscles retaining their tibial insertions.



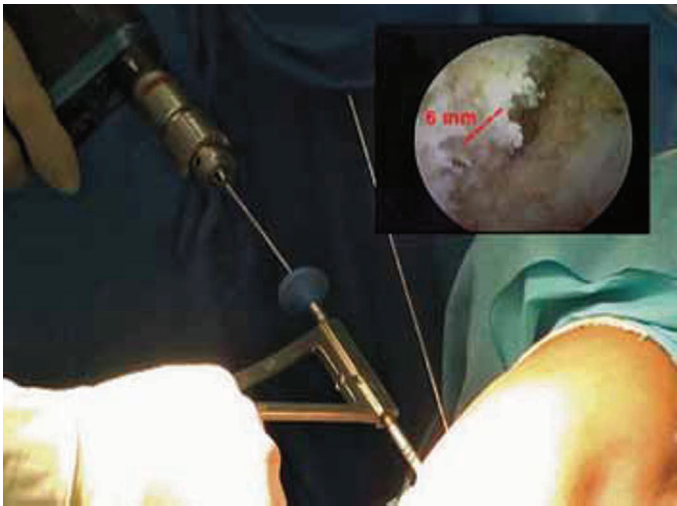
**Figure 2** – The flexor tendons are dissected and their tibial insertions are retained. AMTT – anteromedial tibial tunnel. PLTT – posterolateral tibial tunnel. AMFT – anteromedial femoral tunnel. PLFT – posterolateral femoral tunnel.



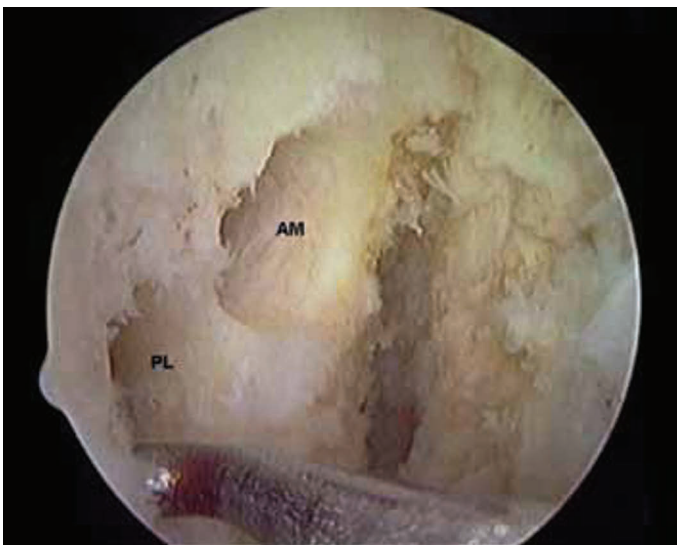
**Figure 3** – Arthroscopic view of the guide wire corresponding to the anteromedial (AM) and posterolateral (PL) tibial tunnels.



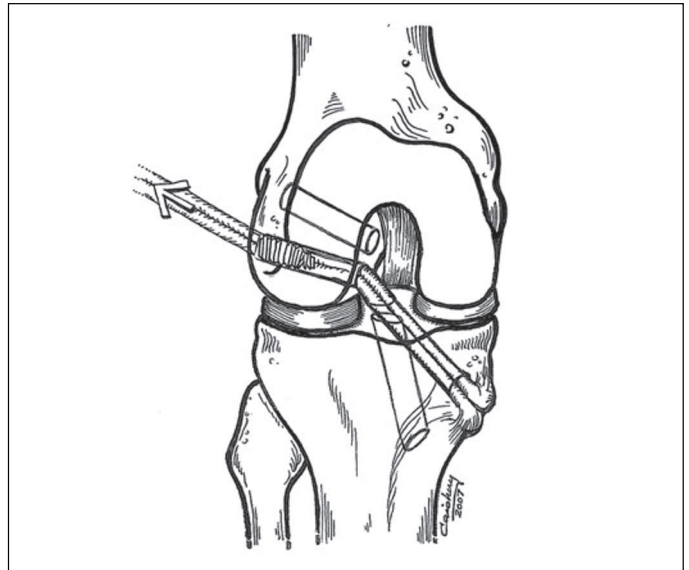
**Figure 4** – Passage and positioning of the guide wire to create the AM femoral tunnel. The arthroscopic view in detail: wire at 9 o'clock – right knee.



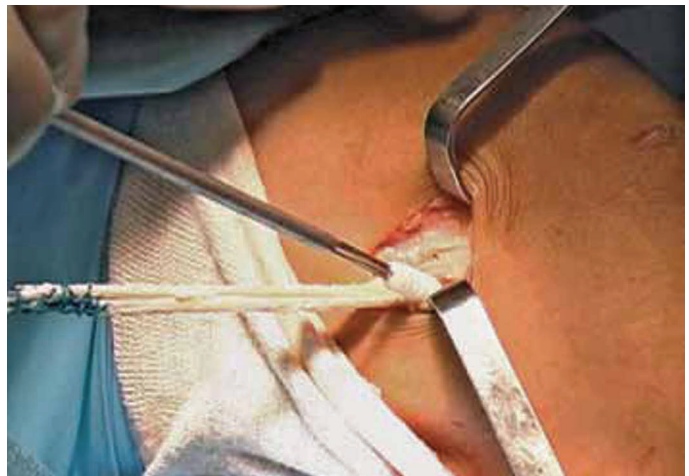
**Figure 5** – Passage of the guide wire to create the posterolateral femoral tunnel with intra-articular placement of both wires in arthroscopic detail.



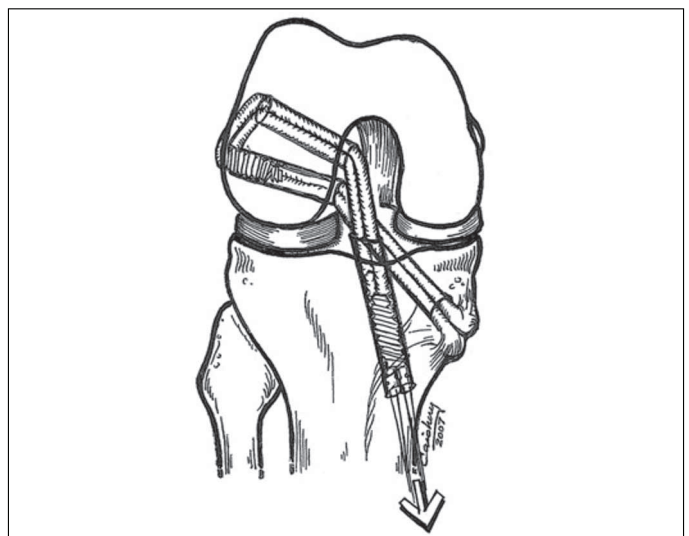
**Figure 6** – Femoral tunnels – arthroscopic view.



**Figure 7** – Femoral fixation from the outside in of the posterolateral bundle with the knee in 15° of extension.



**Figure 8** – Fixation of the posterolateral bundle.

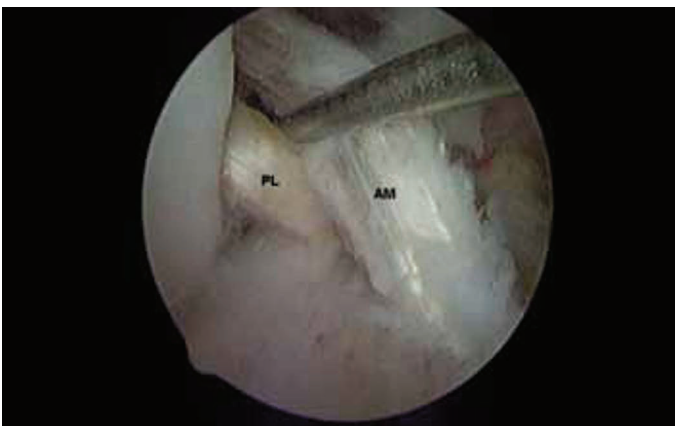


**Figure 9** – Fixation of the anteromedial bundle with the knee in 50° of flexion.





**Figure 10** – Fixation of the anteromedial bundle.



**Figure 11** – AM bundle tensioned in flexion and PL in extension.

The postoperative course is similar to that used in ACL reconstruction with a single-bundle.

## DISCUSSION

The autologous semitendinosus and gracilis tendon graft is used in most of the ACL reconstruction techniques with the double-bundle<sup>(2,8,9,10)</sup>. There are various methods of graft fixation in the literature: two buttons on the femur and two interference screws in the tibia, two buttons on the femur and two buttons on the tibia, two interference screws in the femur and two in the tibia, two buttons on the femur and two staples on the tibia, and two buttons on the femur and tying to a post in the tibia<sup>(2,8-11)</sup>.

The technique proposed by us uses only two interference screws, which is a common synthesis material that is easily obtainable and inexpensive. A comparative analysis of the cost of the synthesis material used

in double-bundle ACL reconstruction, considering the various types of fixation available, is presented in Table 1. This table presents the minimum price quote found for implant materials in three companies in São Paulo. We believe that cost is an important factor to be evaluated in Brazil when we consider that double-bundle ACL reconstruction can provide better results compared with single-bundle reconstruction. In our view, it would not be just for economic factors to limit the use of a technique that aims to further improve the results in our patients. We therefore seek to resolve this problem by developing a simple and low cost anatomical technique that may be performed by most surgeons in our country.

**Table 1** – Comparative analysis of the cost of synthesis materials in the different fixation methods used in double-bundle ACL reconstruction.

Technique	2 femoral buttons + 2 tibial BIS	4 BIS	4 MIS	2 BIS	2 MIS
Cost (R\$)	8,200.00	6,400.00	2,420.00	3,200.00	1,210.00

(March 2009)

MIS – metal interference screw.

BIS – bioabsorbable interference screw.

We consider the preservation of the tibial insertion of the semitendinosus and gracilis tendons as yet another advantage of this technique, because it causes less damage and confers greater viability of the graft<sup>(12)</sup>.

Although the goal of this manuscript is not the presentation of results, we can say that the first 25 patients operated on from July 2007 to March 2009 have been showing very satisfactory progress. A comparative analysis with other techniques is being conducted and we hope to report a more consistent opinion about this technique once we have larger samples and longer follow-up.

## ACKNOWLEDGEMENTS

We thank Prof. Dr. Caio Augusto de Souza Nery, Associate Professor, Department of Orthopedics and Traumatology, Universidade Federal de São Paulo – Paulista School of Medicine, for the illustrations of the surgical technique.

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