


Augmentation of the Anterior Cruciate Ligament Using the Peroneus Longus: Description of the Surgical Technique

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Background: The quadruple graft from the hamstring tendons has become a widely used option in the reconstruction of the anterior cruciate ligament (ACL), however, this graft may not have the desirable diameter for the reconstruction, increasing the risk of re-rupture. In this context, the peroneus longus tendon graft appears as an option to complement other grafts, transforming a thin quadruple graft into a sextuple graft.

Indications: The sextuple graft technique for ACL reconstruction is used in patients who have a quadruple graft with a diameter of less than 8 mm, and due to its length, it is not possible to make a quintuple graft, for example.

Technique Description: Initially, the hamstring tendons are removed with the aid of a tenotome. After that, the anterior half of the peroneus longus tendon is identified and removed. On the back table, the definitive graft is prepared so that we have a sextuple graft with a diameter greater than 8 mm. Finally, the ACL reconstruction is performed anatomically using an adjustable loop device in the femur and an interference screw in the tibia.

Results: In our experience with patients who have a hamstring graft diameter of less than 8 mm, we obtained an average increase of 1.8 mm in graft diameter when augmentation was performed with the anterior half of the peroneus longus.

Discussion: Grafts less than 8 mm in diameter are at increased risk of rupturing and failure of surgical treatment of the ACL injury. The surgeon must be prepared to make a quintuple or sextuple graft, but in some patients, the tendons are short or there is no availability of a tissue bank, making this practice impossible. The use of the anterior half of the peroneus longus to perform graft augmentation is safe, causing almost no morbidity to the donor area and is easily accessible during the procedure, making it an excellent option for increasing the diameter of thin grafts.

Patient Consent Disclosure Statement: The author(s) attests that consent has been obtained from any patient(s) appearing in this publication. If the individual may be identifiable, the author(s) has included a statement of release or other written form.

Keywords: knee; anterior cruciate ligament injuries; knee injuries; anterior cruciate ligament; athletic injuries

VIDEO TRANSCRIPT

The video will show the augmentation technique of the anterior cruciate ligament (ACL) using the peroneus longus.

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In this presentation, we will discuss the background of the ACL injury; present a case; describe the surgical technique of augmentation using the peroneus longus; discuss potential complications, rehab protocol, and return-to-sport; and conclude with patient outcomes.

Currently, one of the main procedures performed in orthopedics is ACL reconstruction. This is due to the high prevalence of injuries to this ligament and the need for surgical treatment in most cases. Most reconstructions are performed with BTB (bone-tendon-bone) grafts or with grafts from the semitendinosus (ST) and Gracilis (G) tendons, forming a quadruple graft¹⁰. These types of grafts in reconstruction have been widely studied in the literature, and the postoperative results are similar.⁷ Removal of the hamstring tendons would cause less morbidity to the donor area when compared to BTB.

For greater success in ACL reconstruction with ST-G graft, this graft must have a diameter equal to or greater



than 8 mm, supporting greater loads and reducing the risk of rupture.¹ Some techniques have already been described to increase the diameter of the graft, such as a quintuple graft in which ST is folded 3 times when the length of the graft is sufficient.⁵ There is also the described possibility of enlarging the graft using a tissue bank allograft.⁷

In order for a tendon to be an ideal graft, it must, in addition to supporting the desired load, be easily and safely removed and not result in any obvious functional damage to the donor site.^{3,6,8,9} The PL muscle tendon graft, in this context, can be used apparently without causing ankle instability or changing gait parameters. It is possible to use this tendon in its entirety or only its anterior portion.^{2,4} The aim of this study is to describe a surgical technique using the hamstring tendons and the anterior half of the peroneus longus (AHPL) to perform reconstruction of the anterior cruciate ligament. This is performed in cases where it is necessary to increase the diameter of the graft to the minimum size of 8.0 mm.

Our patient is a 65 kg, 1.65 m tall, 21-year-old soccer player with pain and instability in his left knee after rotational trauma while playing.

Physical examination showed positive Lachman, anterior drawer, and pivot shift tests for the ACL injury.

The patient did not present any alteration of the ankle.

Magnetic resonance imaging showed only ACL injury.

Surgical treatment with ACL reconstruction was chosen in this case.

A detailed anamnesis must be obtained, and the measurement of anthropometric data is very relevant. Patients with short stature are candidates for hamstring graft augmentation because they do not reach the expected minimum diameter of 8 mm.

It is important to verify whether the patient has previous injuries in the feet or ankles or any limitations that may worsen if the graft is collected from this region.

Some authors have shown that there is no significant loss in the scales of the American Orthopedic Foot and Ankle Society and the Foot and Ankle Disability Index with the removal of the anterior half peroneus longus graft.⁹

It is described that recurrent PL subluxation is a contraindication for the removal of the AHPL.

Surgical technique: The procedure is performed under spinal anesthesia, or general anesthesia, with the patient supine on the operating table with the heels at the end of the table.

A pneumatic tourniquet is placed in the proximal region of the lower limb, to be inflated to 300 mm Hg after exsanguination of the limb and placement of sterile drapes.

Removal of Hamstring Tendons: Initially, it is performed longitudinally from approximately 3 to 4 cm distal to the knee joint, over the topography of the hamstring's tibial insertion. The hamstring tendons are repaired with suture and their proximal insertions are removed with the aid of a tenotome.

On the back table, the hamstring grafts are folded forming a quadruple graft. Its diameter is measured with a sizing block, and when it is smaller than 8 mm and its length

does not allow a safe quintuple formatting, augmentation with the anterior half of the peroneus longus is chosen.

Removal of the anterior half of the peroneus longus tendon: A single longitudinal incision of approximately 3 cm is made in the posterolateral region of the fibula, over the peroneus longus muscle tendon.

The incision is made from distal to proximal, starting 3 cm proximal to the lateral malleolus. After separating the subcutaneous tissue, the PL tendon is identified and isolated with the aid of a hemostatic forceps after distinguishing it from the tendon of the peroneus brevis muscle.

Both fibular tendons are sewed in the most distal region of the incision using simple stitches. A continuous suture is performed in the region of the anterior half of the peroneus longus.

The peroneus longus tendon is incised in an L-shape and repaired with suture.

The anterior half was removed with the aid of a tenotome up to approximately 5 cm from the head of the fibula, avoiding any damage to the fibular nerve.

Graft preparation: The graft from the anterior half of the peroneus longus is very similar to the ST.

The 3 parts are folded in half forming a sextuple graft. Its diameter is measured, and satisfactory thickening is observed.

Arthroscopy standardized anterolateral and anteromedial portal: A high anterolateral portal was chosen, close to the patellar ledge and close to the patellar tendon. The anteromedial portal is performed under direct visualization, with a focus on ensuring a good angle of inclination for the lateral intercondylar wall.

The femoral tunnel is made using the free-hand medial trans-portal technique directly at the anatomical point. Initially, a tunnel is made for the passage of the adjustable loop device, and then a 20-mm-long tunnel is made, according to the diameter of the graft.

As for the tibial tunnel, a proper guide is used to perform the tunnel from the outside to the inside, also according to the diameter of the graft.

The sextuple graft is pulled through the tibial tunnel until reaching the femoral tunnel with the aid of a thread. The proximal portion of the graft is fixed to the femur with an adjustable loop suspender device.

After pre-tensioning the graft, the next step is to fix the lower end to the tibia with an absorbable interference screw. Fixation is performed by pulling the graft, fully extending the knee.

Potential complications: Check if the patient has any injury or instability in the ankle and foot before performing the removal of the peroneus longus graft. This can be a postoperative complication factor.

It is important to use the tenotome gently on the proximal region of the leg to avoid any type of injury to the peroneal nerve.

Rehabilitation protocol and return to sport: Although we removed a graft from the ankle region, the rehabilitation protocol follows the standard for ACL reconstruction with hamstrings.

Patient outcomes: In an initial series of 14 cases carried out by our group, we obtained good postoperative results.

The mean size of the graft before augmentation was 6.7 mm and after it was 8.5 mm, exceeding the recommended value.

All patients improved on the LYSHOLM Knee Score Scale and on the International Committee for Documentation of the Knee Subjective Knee Form scorecard at the 6-month follow-up after the described surgical intervention.

The technique can be easily performed and results in little morbidity at the donor site, increasing the diameter of ST and G grafts smaller than 8 mm, decreasing the probability of new ruptures.

The following are our references.

Thank you for your time.

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