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Short Communication

ACL Reconstruction Using a Fascia Lata Graft for Anatomic Femoral Direct Fiber Restoration

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Introduction

ACL reconstruction techniques have constantly been refined to optimize clinical outcomes. A substantial body of research has focused on different factors affecting ACLR outcomes including graft options as well as technical aspects such as tunnel placement and ACL footprint coverage. However, modern ACL reconstruction techniques typically fail to restore native ACL kinematics based on incomplete or inaccurate restoration of native ACL insertional anatomy. The broad and thin direct femoral ACL insertion close to the resident´s ridge is currently not accurately restored through conventional single bundle ACLR and thus, altered biomechanics represent a common finding following ACLR. Double bundle reconstruction techniques have been introduced to improve native ACL footprint coverage, but clear functional and clinical superiority of double bundle ACLR has yet to be proven. It has been hypothesized that separate bundles may not restore the biomechanical principle of smaller bundle units resisting multidirectional forces. To address this principle, the two bundles must represent interacting portions with a gradient across a higher structure. In the present article, we describe a novel technique using a single fascia lata graft in combination with Fiber-Tag (Arthrex, Naples, FL) for complete restoration of the femoral direct fiber insertional anatomy. The graft mimics the ribbon-like flat geometry of the native ACL with interacting anteromedial and posterolateral portions. This technique is recommended for all types of complete ACL ruptures. Clinical studies are needed to assess if the more complete restoration of the direct insertion may theoretically be associated with improved biomechanics, increased likelihood of RTS, lower risk of ACL graft failure as well as joint degeneration.

Surgical technique

The patient is positioned supine under general anesthesia. The leg is secured in a leg holder and a tourniquet is applied. It is ensured that hyperflexion is possible for AM portal tunnel reaming. A single intravenous dose of 1,5 g Cefuroxim antibiotic prophylaxis is given. The leg is prepared for surgery following standard protocols.

Diagnostic arthroscopy

Following a thorough assessment of global ligamentous integrity under general anesthesia, a high anterolateral and a low anteromedial portal is established. A diagnostic arthroscopy is performed using a standard 30 degrees optic device. Concomitant pathology is assessed and treated accordingly.

Graft harvest and preparation

The fascia lata graft is harvested from a safe zone. The lateral boundary of the safe zone is located 4 cm anteriorly to the intermuscular septum to preserve a sufficient and functional ITB strip. The caudal boundary of the safe zone is located 10 cm superior to the lateral femoral condyle to preserve parts of the anterolateral complex of the knee. The cranial boundary of the safe zone is located 15 cm distal to the anterior iliac spine to preserve parts of the tensor fascia lata muscle [1]. Cranially within these boundaries, a 2 cm transverse incision is made, and the FL is exposed through blunt dissection. An elevator is used to create a tunnel under the skin flap. The FL is incised and mobilized from underlying muscle tissue. Two parallel cuts are made with long scissors along the length of the FL. The free cranial edge is grasped with an artery forceps and pushed caudally. The artery tip is then held against the skin, where a small inferior incision is made. The graft can then be fully detached through this incision. A FL graft-sheet of up to 20 cm × 4 cm can be harvested and folded for augmentation. The graft is folded longitudinally and transversely to create a four-layered graft of 2 cm width and 8-10 cm of length. Two Fibertags (Arthrex) are positioned at one end of the graft at each side. The middle part of

the graft between the Fibertags is removed, creating a horizontal edge. The other end of the graft is sutured with Fiber wire (Arthrex) sutures at both sides. The graft is then ready for implantation.

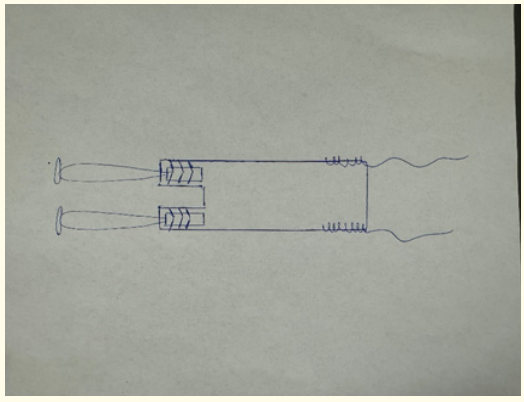
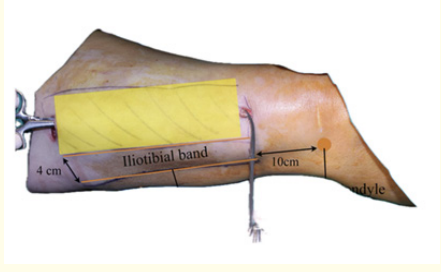


Figure 1: A four-layered 2 x 8 cm fascia lata graft. On the left side two fibertags are mounted. On the left side, two pull sutures are established.



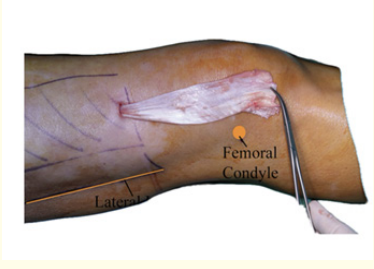


Figure 2

Tunnel preparation

The femoral ACL insertion site is inspected. ACL remnants and tissue are cleared from the medial side of the lateral condyle until the posterior femoral back wall and back wall-roof junction are clearly visible. A microfracture owl is used to mark the AM and PL tunnel positions. For the AM tunnel, a mark is made on a tangent connecting the cartilage-bone junction and the highest distal outlet point of the notch as far posterior as possible, leaving a 1-2 mm tunnel backwall. For the PL tunnel, a mark is made on a slightly curved line connecting the AM tunnel with the most distal point of the condylar cartilage margin, leaving a 1-2 mm tunnel wall to the cartilage margin. A 2.9 mm mm drill pin is inserted through the AM portal and lightly inserted into the AM marking point. The knee is then brought into hyperflexion, and the drill-pin is drilled into bone and through the lateral femoral cortex. The drill pin is over drilled with a 6 mm reamer. The procedure is repeated for the PL marking point. With a small round bur, a curved ridge is established connecting the tunnels. The ridge should lie within the area of the direct femoral ACL insertion posterior to the resident´s ridge extending no more than 5 mm posteriorly to the resident´s ridge. Bony debris is removed with a shaver. The tibial insertion site is inspected, including visualization and resection of potential cyclops formations. In 90 degrees of flexion, a tibial guide device, typically with a 55-degree angle, is inserted into the joint. The aimer device is placed centrally at the AM bundle position. A drill pin is inserted through the aiming device and over drilled with a 10 mm reamer.

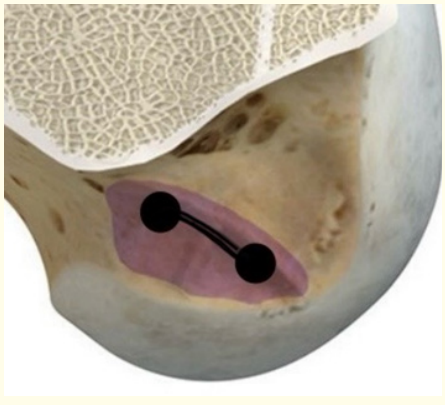


Figure 3: Anteromedial and posterolateral femoral tunnel location. A ridge is created between the two tunnels for the horizontal free edge of the graft.

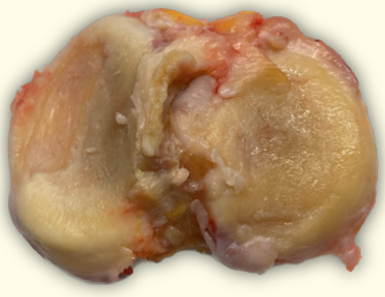


Figure 4

Graft implantation

Passing sutures are placed through both femoral tunnels and are retrieved through the tibial tunnel. The graft is pulled into the joint and the AM and PL portions are inserted into their respective femoral tunnels by toggling the Fiber-Tag devices. The AM and PL graft portions are pulled into the tunnels until the free horizontal edge of the graft has entered the curved ridge. The knee is extended, and the graft is positioned into an anteromedial position within the tunnel. A 10 x 30 mm interference screw is inserted into the joint while applying a one-handed maximal pull on the graft. The screw can be advanced near the joint but screw protrusion into the joint should be avoided.

Postoperative rehabilitation

A structured rehabilitation protocol is recommended following ACLR. Central aspects of the rehabilitation sequence can be summarized through the acronym WORLD-CUP. Walking, One-legged squatting, Running, Landing, Decelerating/dropping, CUtting, Playing. Weight bearing is typically allowed in the absence of significant pain and effusion in accordance with relevant concomitant injury protocols. Braces may be used in specific cases, e.g. in the setting of concomitant meniscal root repair.

Bibliography

1. Tay VS., *et al*. "Minimally invasive fascia lata harvest: a new method". *Plastic and Reconstructive Surgery - Global Open* 1.1 (2013): e7-e8.