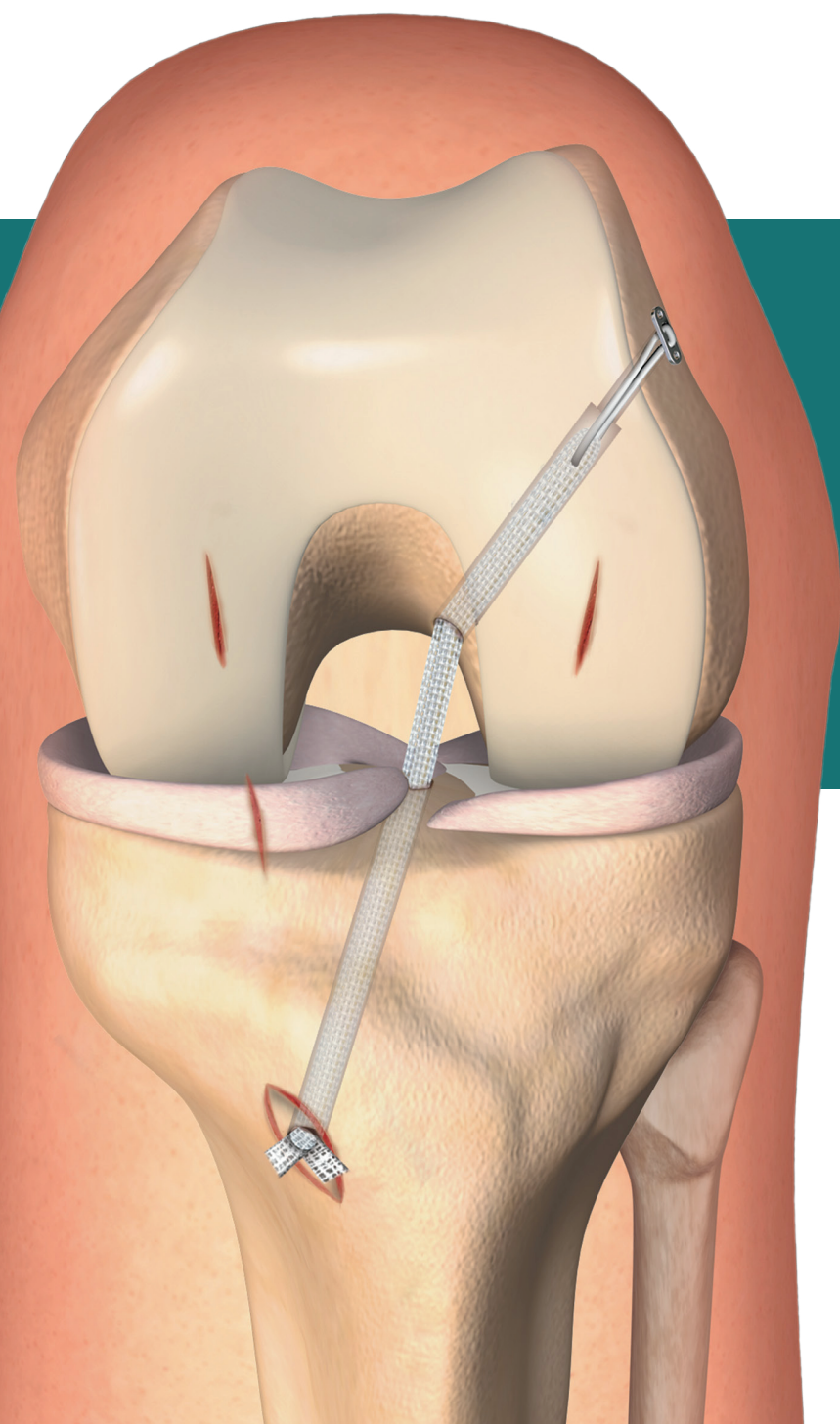




JewelACL™

for ACL Reconstruction

Surgical Technique Manual

Preserving Biological Capital™

Product Overview

INTRODUCTION

The JewelACL is a tissue graft-sparing device for the reconstruction of the anterior cruciate ligament (ACL).

It has been designed for use in standalone ACL reconstructions; this is the manufacturer's recommendation. Should the surgeon wish to use the device in conjunction with a hamstring tendon graft, preferably the gracilis tendon is recommended.

The use of the JewelACL in either way will significantly reduce or totally eliminate the need to harvest autologous tissue for the reconstruction. This reduces the surgical time, reduces or totally avoids the occurrence of donor site morbidity and deficiency in the hamstring muscle group.

The reconstruction of the ACL with a standalone JewelACL thus preserves the patient's biological capital. This is not only the muscle bulk, but also the bone stock due to the smaller diameter of the bone tunnels required for the implantation of the device.

Use of the JewelACL in ACL reconstructions allows early mobilisation and weight-bearing rehabilitation. This is facilitated as the initial strength of the JewelACL remains unchanged throughout the healing process.

The JewelACL is a specialized textile implant which is rendered versatile for use in ACL reconstruction by various features illustrated in Figure 1.

It is manufactured from Polyethylene Terephthalate (Polyester) which has been used in vascular grafts and hernia patches for over 50 years, and in ligament reconstruction for over 40 years.

Product Overview

The surface is modified with a unique gas plasma treatment process that renders the surface hydrophilic^{1 2}. This treatment accelerates cell adhesion to the implant surface.

Openings in the tubular structure allow harvested tissue to be placed inside the implant.

The densely woven section indicates mid-length where the device is looped around a femoral suspensory fixation device.

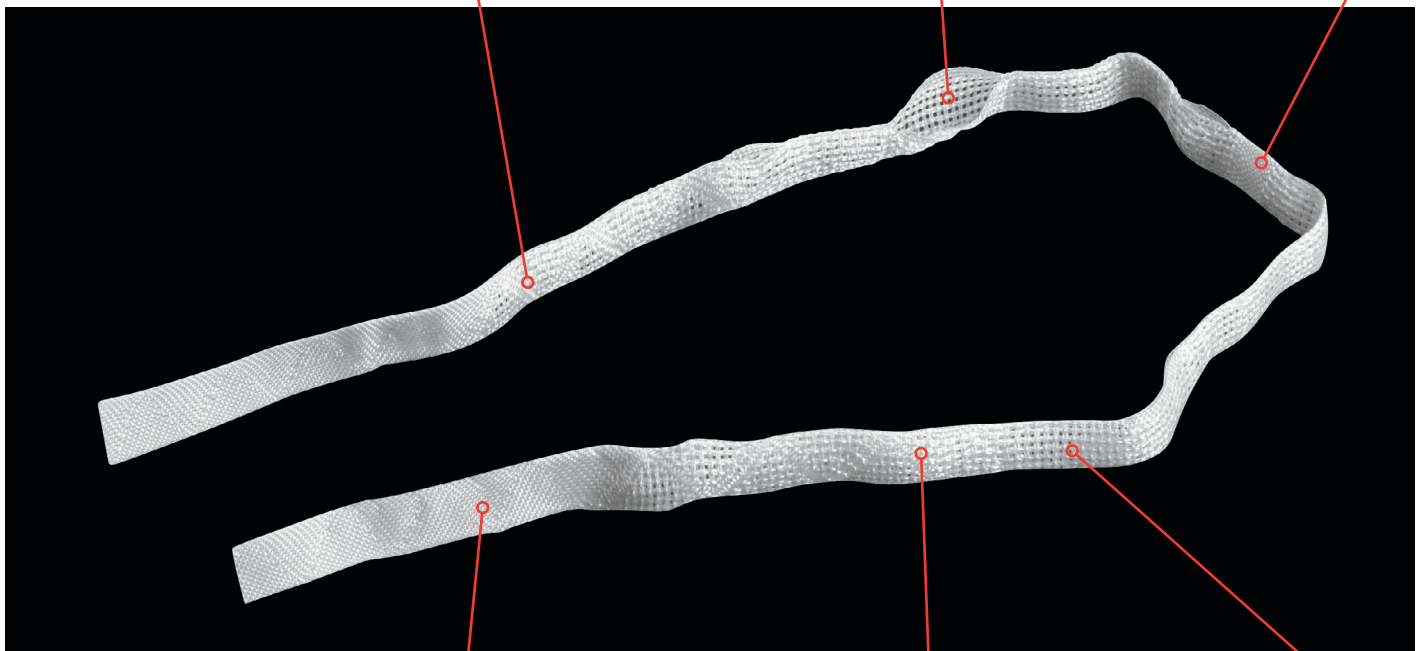


Figure 1 - Features and Benefits of the JewelACL

Densely woven section improves handling when applying tension on the device during tibial fixation.

Tensile strength for a single strand matches that of the semitendinosus tendon which is typically 1200 N. When doubled over, the device has a strength comparable to that of the native ACL.

The loosely woven structure allows for colonization by tissue. This tissue is subsequently modelled under the influence of cyclic forces acting on the device during the recipient's activities³⁻⁶. This is a natural body response to all implants.

The JewelACL was specifically designed for implantation with approaches that are **familiar to most surgeons**.

Thus, bone tunnels may be prepared with appropriate standard instrumentation in current use. The femoral tunnel is prepared via an anteromedial portal, rather than via the transtibial approach because of the narrow tibial tunnel used in this procedure, which may result in inaccurate placement of the femoral tunnel.

Also, the JewelACL (alone or in combination with a hamstring graft) may be secured to the bone with cortical suspensory fixation with loop or soft threaded interference screw fixation (Figure 2). Further details are included below and later in the surgical technique.

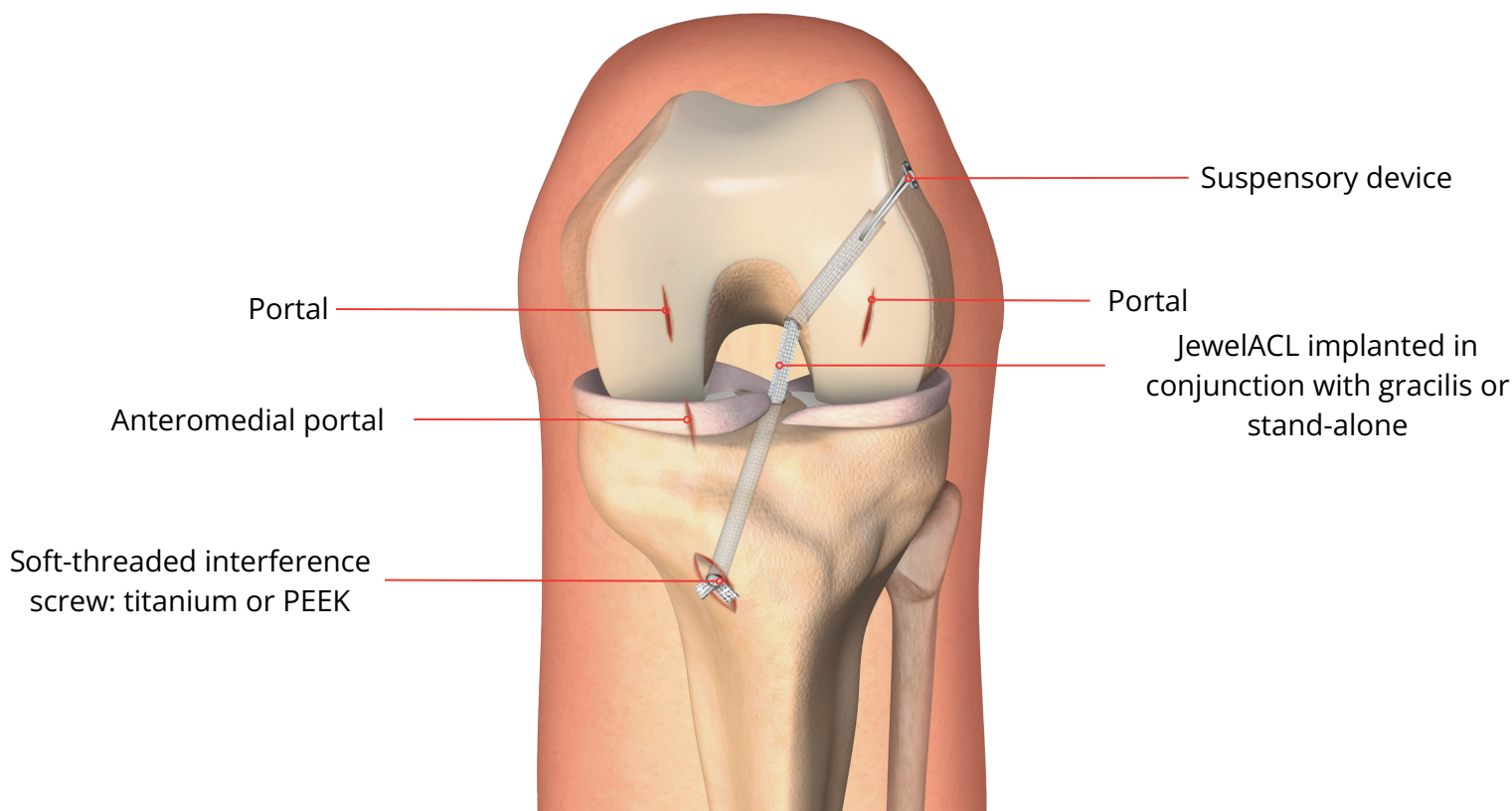


Figure 2 - Diagram of JewelACL in situ

FEMORAL TUNNEL DIMENSIONS

- **Through tunnel to cortex:** As per the suspensory fixation device of choice.
- **Socket:** 6 mm for standalone JewelACL ACLR, or hybrid as per graft diameter measurement.

TIBIAL TUNNEL DIMENSIONS

- 6 mm for standalone JewelACL ACLR.
- As per graft diameter for hybrid ACLR with gracilis.

INTERFERENCE SCREWS & DIMENSIONS

Soft threaded interference screws are recommended; these can be made of titanium or PEEK, but not from bioabsorbable materials (These have not been tested and so cannot be recommended.)

The diameter of the screw should be 1mm larger than the tunnel diameter. If the tibial bone is soft, as is the case with the tibial bone, the screw diameter may be 2 mm larger than the tunnel diameter.

JewelACL Surgical Technique

INTRODUCTION

The JewelACL can be implanted adopting the same technique for ACLR with hamstring tendons. The reconstruction can therefore be performed using commonly available contemporary instrumentation.

The instructions below describe an anteromedial approach with the JewelACL in stand-alone technique. The reconstruction procedure incorporating a gracilis tendon is identical except for the slight differences in the bone tunnel diameters as indicated above, with the steps to incorporate the tissue in the JewelACL device shown below.

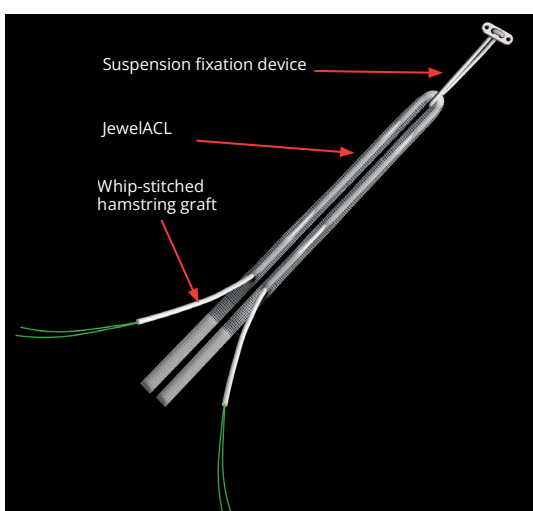
Since the above procedure for ACL reconstruction is well known, the following text focuses on the important differences from a standard ACL technique.

PATIENT PREPARATION

The procedure is performed with the patient in the supine position under general anaesthesia or spinal (regional) anaesthesia with a tourniquet inflated. Pre-operative antibiotics are administered.

The pre-operative preparation of the patient is carried out following standard procedures. When adopting an anteromedial approach, the patient should be positioned so that the knee can be flexed beyond 90°.

INCOORPORATING TISSUE IN THE JEWELACL DEVICE



To incorporate the tissue graft in the JewelACL Device, it is prepared according to standard procedures, such that each end is whip-stitched with sutures to a length of ~35-40 mm. The tendon can be placed alongside the JewelACL to effectively create a 4-strand graft, or preferably placed inside the tubular JewelACL as follows:

The ends of the sutures are threaded through the eyelet of a passing pin. The pin is passed through the appropriate openings in the JewelACL, taking care not to pierce it with the pin. The passing pin is used to pull the tendon inside the JewelACL such that the tendon is located midway along the length of the JewelACL, thus forming a composite graft. Measure the diameter of the graft to determine appropriate socket sizes. This is likely to be between 7 and 7.5 mm².

Surgical Technique



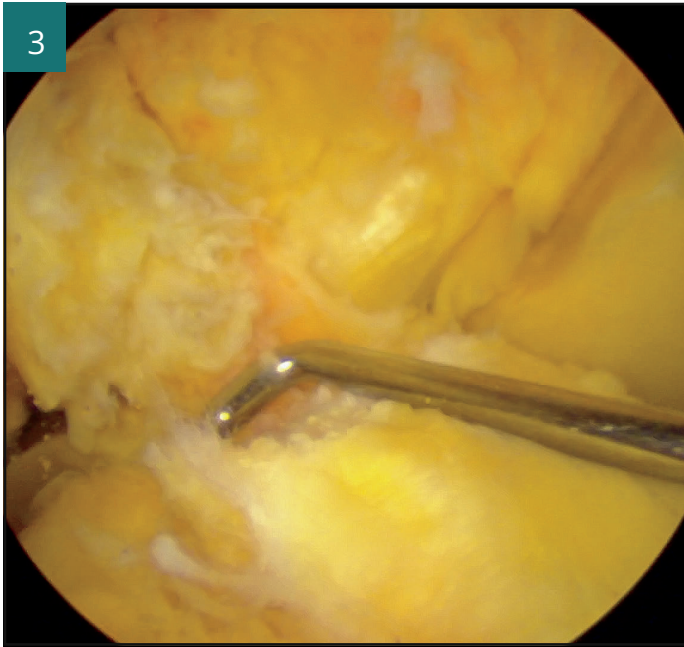
POSITIONING OF THE PATIENT

Patient positioning on the table is as per surgeon's preference, but making sure that full knee Flexion is achievable.



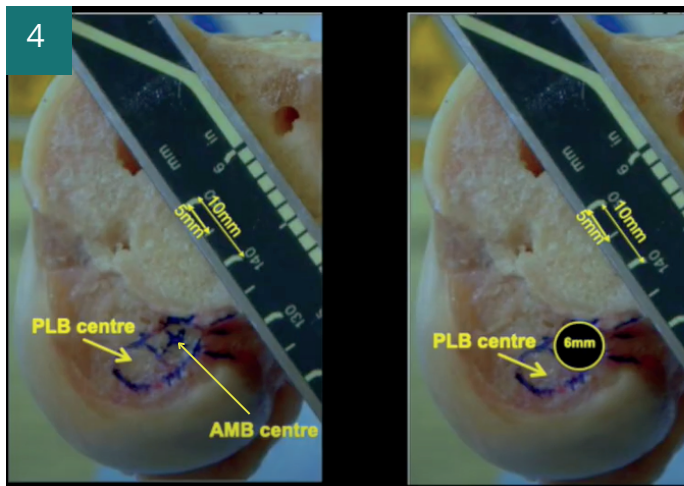
ARTHROSCOPY PORTALS

Adopt standard Anterolateral and Anteromedial portals.



ASSESSMENT OF ALL JOINT STRUCTURES

Conditions of joint structures should be assessed, and undertake appropriate repairs, for instance, of meniscal damage, before reconstructing a ruptured ACL such as this.



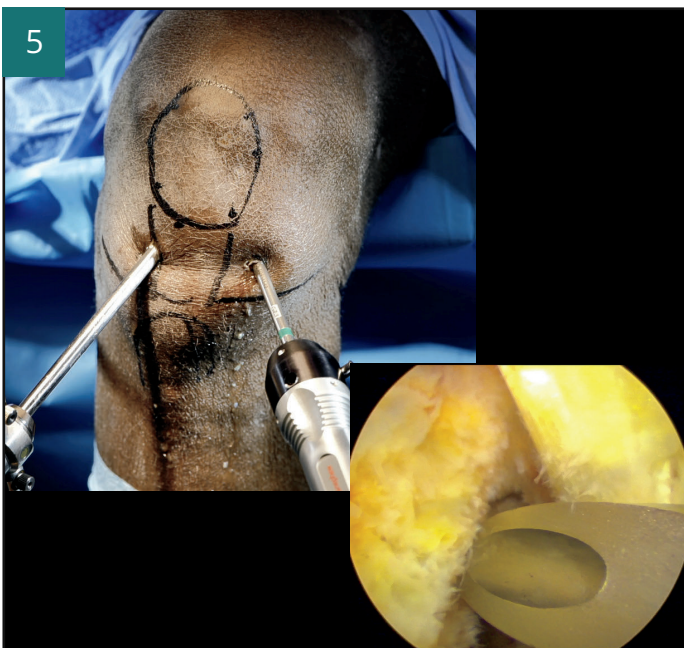
EXPOSING AMB FOOTPRINT, THE SITE FOR ISOMETRIC PLACEMENT OF THE GRAFT

The closest site to isometric graft placement is the footprint of the Anteromedial Band (AMB). To identify and expose this site, it would help to shave off some of the soft tissues in the ACL footprint, which will also show the posterior cortex of the lateral condyle.

The left picture shows the notch side of the lateral femoral condyle with the AMB footprint, and its centre is indicated by the arrow.

A 6 mm-diameter femoral socket comfortably occupies the footprint of the AMB and so places the graft closely in the 'isometric zone'.

This is where the femoral tunnel will be drilled, which is our next step.



PREPARATION OF THE FEMORAL TUNNEL

The femoral aiming device with offset 5 mm may be used, as the diameter of the femoral socket is 5.5 to 6 mm for standalone use of the graft.

Perform this step with the knee in full flexion to ensure a satisfactory direction of the tunnel axis and of its exit on the lateral cortex of the femur.

Introduce the femoral aiming device through the anteromedial portal making sure that the aiming device is placed behind the posterior cortex and oriented towards AMB footprint.



MAKING INITIAL STAGE OF THE FEMORAL TUNNEL

Introduce a 2.4 mm k-wire through the aimer driving it through the femoral condyle, until it exits the lateral femoral cortex.

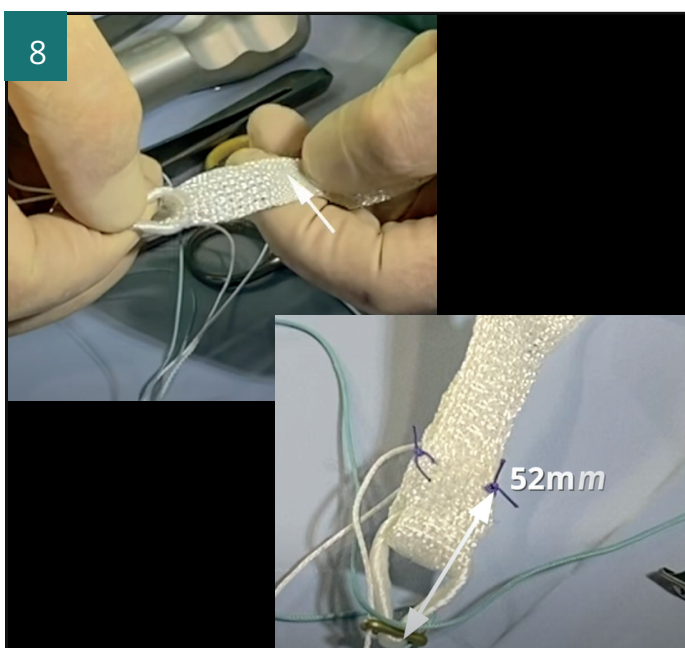
Remove the aimer and over-drill the k-wire with a 4.5 mm drill through both the cortices.

Alternatively, this step may be performed fluoroscopy-assisted without the use of an aimer, by introducing the k-wire at the centre of the AMB.



MEASURE THE LENGTH OF THE FEMORAL TUNNEL

Remove the k-wire and use the provided instrument, or any other means, to measure the length of the femoral tunnel. This tunnel is 45 mm long.

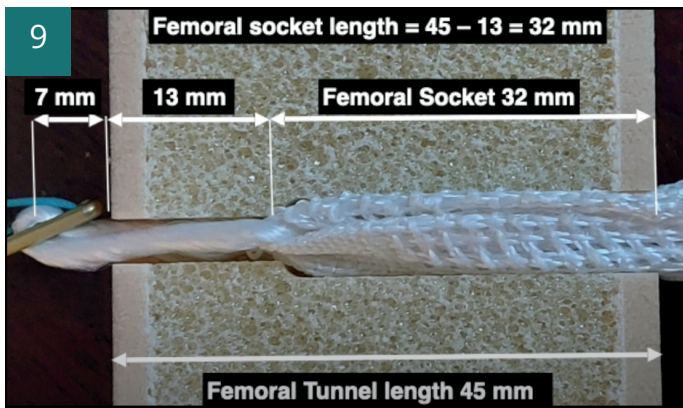


GRAFT ASSEMBLY

This step takes place on a side table.

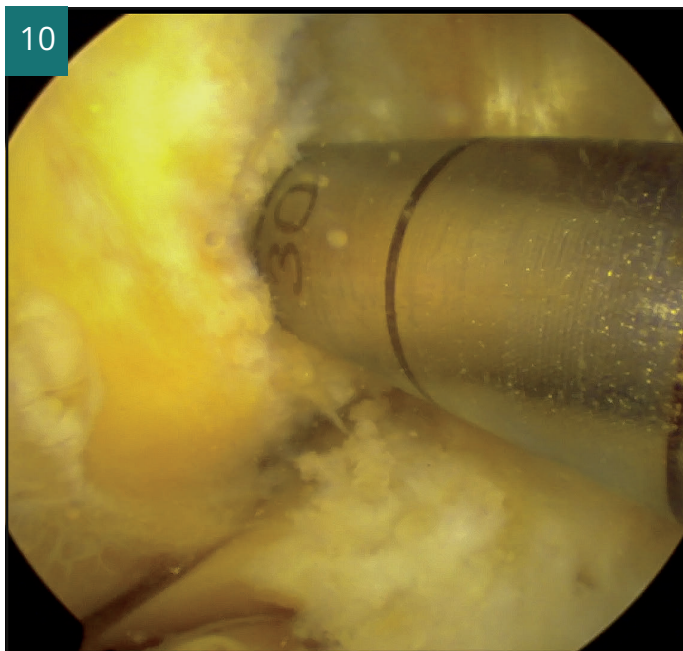
A Suspensory Device with a 20 mm loop is chosen for this case. The JewelACL device is passed through the loop and folded on it at the central section of the device, which is densely woven. The device is thus evenly suspended by the loop.

The folded device is stitched with marking sutures on both of its sides at a distance of 52 mm from the Suspensory Device. This distance is 7 mm longer than the femoral tunnel. As the JewelACL is drawn through the femoral tunnel, when the marking sutures just disappear at the mouth of the femoral socket, the button will have cleared the femoral cortex and will then be ready to be flipped.



NOTE: LENGTH OF THE FEMORAL SOCKET

The length of the femoral socket must allow the button of the suspensory device to clear the femoral cortex in order to be able to flip it. The length of the socket is equal to the length of the femoral tunnel (45 mm) minus the length of the loop occupying the femoral tunnel (20 mm - 7 mm = 13 mm). This allows the tip of the Suspensory Device to clear the cortex. In this case, the length of the socket is calculated as 45 mm - 13 mm = 32 mm. The femoral socket length will be different if the length of the femoral tunnel was different from that in the current case.



DRILLING THE FEMORAL SOCKET

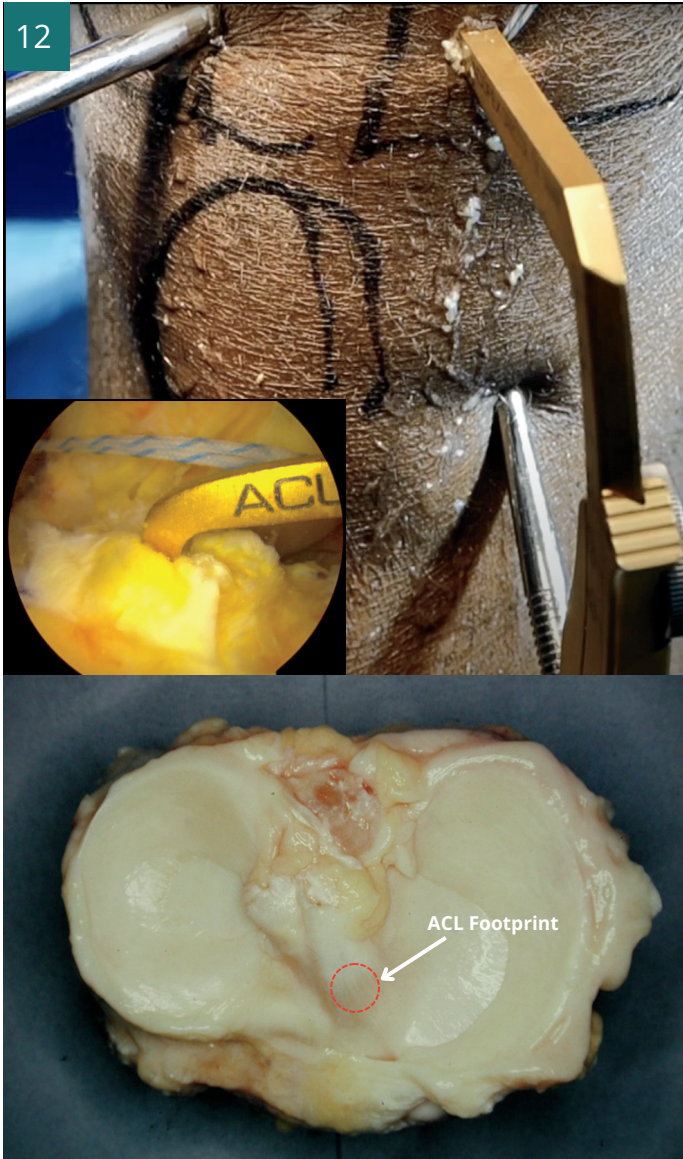
Reintroduce the K-wire into the femoral tunnel and use a reamer 6 mm in diameter to over drill the femoral socket to a depth of 32 mm.

Round off the edges of the femoral socket.



PLACE A PASSING SUTURE IN THE FEMORAL TUNNEL.

The guide wire with eyelet is used to place a passing suture through the medial portal to the femoral tunnel. The suture is externally secured around the femur.



TIBIAL TUNNEL PREPARATION

This step is performed with the knee flexed at 90 degrees.

A dedicated ACL tibial aiming device is used to establish the exit of the tibial tunnel in the joint cavity.

The tibial tunnel should occupy the footprint of the AMB on the tibia, and so avoiding damage to the anterior horns of both menisci.

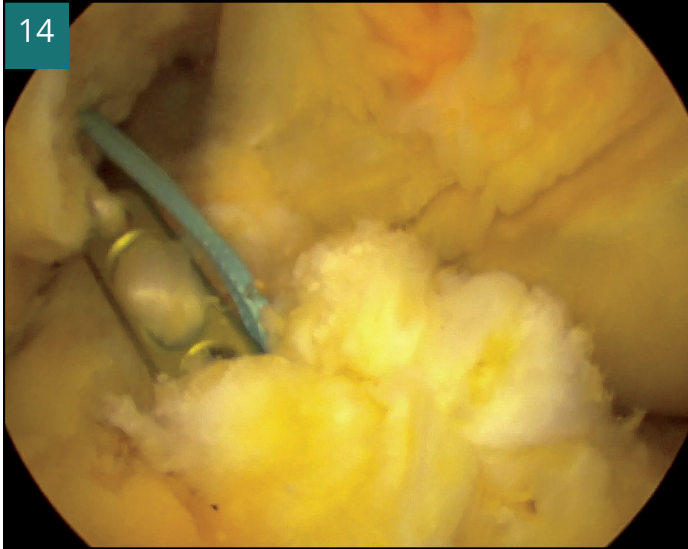
After securing the aiming device pass the guide wire through so it exits at the centre of tibial AMB footprint. This slide clearly illustrates the optimal position of the tibial tunnel.



DRILLING THE TIBIAL TUNNEL

Remove the aiming device and form the tibial tunnel by over-drilling the passing wire with a size 6 mm reamer. Measure the length of the tunnel, this will help when selecting the appropriate length of the interference screw

14



ADVANCING THE GRAFT THROUGH THE TUNNELS

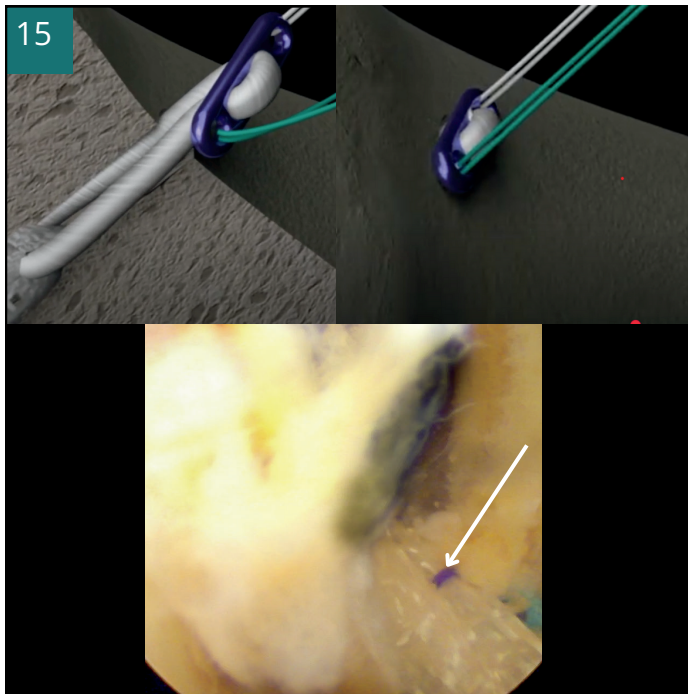
Draw the passing suture emerging from the femoral tunnel through the tibial tunnel.

Then fold both the pulling and flipping sutures of the Suspensory Device over the loop of the passing suture.

Pull the passing suture till both the pulling and flipping sutures of the Suspensory Device emerge out on the lateral aspect of the femur.

Next, by pulling the Suspensory Device's pulling suture, slowly advance the JewelACL into the tibial tunnel and then into the femoral tunnel.

15



SEATING THE SUSPENSORY DEVICE ON THE FEMORAL CORTEX

When the blue marking sutures on the edges of the JewelACL disappear through the mouth of the femoral tunnel, the Suspensory Device will have cleared the cortex of the femur. Now pull the flipping suture to seat the Suspensory Device flat on the femoral cortex.



CYCLING THE KNEE

Pull along the JewelACL exiting from the tibial tunnel to confirm that the Suspensory Device is securely seated on the femoral cortex.

With the graft under tension subject the knee to a number of cycles of Flexion and Extension.



PREPARING FOR TIBIAL FIXATION

Place the knee into full extension and with the tibia pushed against the femur, introduce a guide wire in the tibial tunnel between the two ends of the JewelACL.

It is important to ensure that the guide does not pierce the structure of the device. If it did the device structure may be damaged by the interference screw when it is introduced into the tibia.

To avoid the above from happening, the two ends of the device must be separated and put under tension before gently introducing the guide wire.



FIXING THE JEWELACL AT THE TIBIA

With the knee in full extension, and while maintaining tension on both legs of the JewelACL, a soft threaded screw is introduced to three-quarters of its length into the tibial tunnel. The diameter of the screw should be 1 mm greater than that of the tunnel. In case of soft tibial bone, as the case can be in a cadaveric joint, the screw diameter should be 2 mm greater than that of the tibial tunnel diameter.



19

CHECKING GRAFT TENSION

Under direct vision, assess the tension of the graft using an arthroscopy hook.

If the graft tension is not adequate, remove the screw, and with the knee fully extended, apply tension on the graft repeating the above step.

Now with the graft tension adjusted, introduce the screw fully until it is flush with the tibial cortex.

If an adjustable suspension device is used at the femur, the graft tension can be more readily fine-tuned, without the need to remove the interference screw.

20

TRIMMING THE LIGAMENT ENDS

While firmly gripping both ends of the graft, a sharp scalpel is used to cut both of its ends as closely as possible to the bone.

Finally, the portals and the small incision at the tibia are closed.

Postoperative Management

The JewelACL does not require any specific modifications to standard ACL rehabilitation protocols. An example programme developed in conjunction with Ian Horsley MSc, MCSP, Clinical Lead Physiotherapist, English Institute of Sport, BackinAction Physiotherapy and Sports Injury Clinic, Wakefield, UK, is available for download from the Xiros website. Document reference; **JewelACL** Rehabilitation Programme: For Anterior Cruciate Ligament Reconstruction (LAB 145).

The rehabilitation programme should be supervised by a specialist physiotherapist. All mobilisation and exercises should be performed within the pain free range of movement.

The above stepwise surgical technique is derived from and aligned to that which is demonstrated by Dr Klaudiusz Kosowski in the video posted on the YouTube channel: [JewelACL Surgical Technique Video: Step by step guide](#)
Filming and Photography by Ramón De Juan, Institute of Medical Illustrators.

References

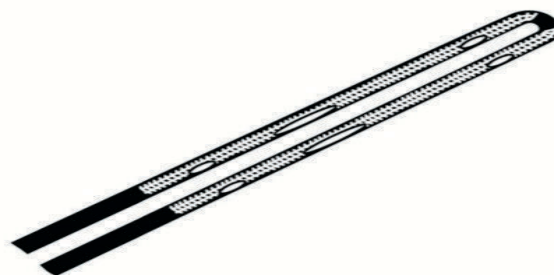
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6. **Stefano Zaffagnini, Giulio Maria, Marcheggiani Muccioli, Vikram Chatrath, Alice Bondi et al** (2008), Histological and ultrastructural evaluation of Leeds-Keio ligament 20 years after implant: a case report *Knee Surgery, Sports Traumatology, Arthroscopy*, Volume 16, Issue 11, pp 1026–1029

Ordering Information

Implant

102-6003 JewelACL 7 mm ID x 710 mm (supplied sterile)



Please refer to the Instructions for Use leaflet packed with the **JewelACL** for essential information including Use, Sterility, Indications, Contraindications, Warnings and Precautions, Potential Adverse Effects and Storage. Additional copies may be obtained from the Xiros™ Sales Department, or downloaded from www.xiros.co.uk



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