MCL Reconstruction and Reinforcement
Surgical Technique
Corin would like to thank Mr S Church for his input to this surgical technique.
Overview

LARS™ is a range of versatile synthetic ligament augmentation and reconstruction devices, suitable for a wide variety of applications. The LARS™ ligament is used as an internal fixation device, providing immediate stability and allowing restoration of knee function. The intra-articular longitudinal fibres resist fatigue and allow fibroblastic in-growth\textsuperscript{1,2,3,4,5}, whilst the extra-articular woven fibres provide strength and resistance to elongation\textsuperscript{3,4,5}. LARS™ can be used in conjunction with the remnants of the ruptured ligament, or as reinforcement of an autologous reconstruction. In both cases, LARS™ protects the original ligament tissues during the immediate post-operative period.
**Indications**

LARS™ ligaments can be considered for:
- Multiple Ligament Injuries
- Late or Chronic Injuries

**LARS™ synthetic ligament composition**

Mechanical in vivo tests for resistance, fatigue and creep have shown that LARS™ ligaments are highly effective ligament reconstruction and augmentation devices and clinical results are excellent\(^3,6,7,8\).

LARS™ ligaments are manufactured in a range of sizes, with various numbers of longitudinal fibres corresponding to varying resistance to elongation and tensile strength. The strength of LARS™ ligaments is approximately 1,500N for 30 fibres, 2,500N for 60 fibres, 3,600N for 80 fibres and 4,700N for 100 fibres\(^3\).

**General considerations**

LARS™ ligaments must always be placed in an anatomical and isometric position. When positioning the ligament, it is essential to avoid any abrasion within the joint or obstruction with other surrounding tissues, as this may lead to wear of the ligament fibres\(^4,5,7\). It is also important to avoid placing the free fibres portion of the LARS™ ligament within the tunnels or at the tunnel edges as these fibres are more prone to damage when in contact with sharp bony edges. At least 2mm of the extra-articular fibres should be visible outside the tunnel entrance, to minimise risk of long-term wear of the ligament.

Acute angles of bone tunnels must be avoided. The diameter of the bony tunnels must correspond to the specific technique for each type of ligament and should typically be as small as possible to encourage bony tissue in-growth.

Due to the stiffness of a LARS™ ligament it is crucial to implant the ligament in an isometric and anatomic position with final fixation at the angle where the ligament is longest to avoid any excessive strain on the ligament fibres. LARS™ ligaments should not be over-tensioned during fixation as this will restrict motion and cause undue strain on the ligament. The tension should not be more than that of the repaired anatomic ligament.

The fixation of the ligament is carried out using dedicated cannulated interference screws, which do not damage the ligament and provide maximum contact with the tunnel wall. As a general rule, the interference screw size should be at least 1mm bigger than the tunnel size and its length should be the longest permissible, dependent on tunnel length. The use of resorbable screws is not recommended with the LARS™ ligament.

**LARS™ in MCL reconstruction**

The MCL 32 ligament is the graft option for MCL reconstructions. Use one MCL 32 ligament for the single bundle sMCL technique, and two MCL 32 ligaments for the double bundle sMCL and POL reconstruction technique.

<table>
<thead>
<tr>
<th>Ligaments</th>
<th>Strength (N)</th>
<th>Tunnel ø (mm)</th>
<th>Ligament diameter (mm)</th>
<th>Screw size (mm)</th>
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<tbody>
<tr>
<td>MCL 32</td>
<td>1500</td>
<td>Femur: 4.5 or 5.0</td>
<td>Flat portion: 170 x 20 Cord: Ø4.5 x 150</td>
<td>Ø6.0 x 30 (may need up to Ø7.0 or Ø8)</td>
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A LARS™ MCL 32 is comprised of a 30 mm free fibre section with a 150 mm long intraosseous cord at one end, for the femoral tunnel attachment, and a 170 mm long flat portion at the other end, for the tibial attachment. The free fibre section is designed to lie flat across the joint line to avoid protrusion.

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\(^3,6,7,8\)
Surgical approach
The patient is set up lying supine with the knee flexed to 90°.

Single incision
A single incision approach is recommended, allowing for the LARS ligament reconstruction to be performed beneath the superficial MCL (sMCL).

A longitudinal incision is made starting from just proximal to the medial epicondyle on the femur to the MCL insertion 50 - 60mm distal to the joint line along the subcutaneous border of the tibia near the pes anserinus. Carefully dissect through layers 1 (superficial fascia) and 2 (sMCL) in line with the fibres of the sMCL. Using the LARS™ MCL 32 ligament, the reconstruction is carried out and the fibres of the sMCL are closed over the LARS ligament.

Double incision
The femoral incision is made over the medial femoral epicondyle. A 20mm incision is made parallel to the femoral shaft over the medial epicondyle. The medial epicondyle is exposed using careful dissection. X-ray can be used in theatre to clearly identify the position of the medial epicondyle.

The tibial incision can be the same as that used for hamstring harvesting. A 2cm incision is made proximal to the pes anserinus allowing access to the tibia just proximal to the distal hamstring insertion.
LARS™ anatomic MCL reconstruction technique summary

1. Tibial fixation, distal staple
2. Tibial fixation, proximal staple
3. Identification of isometric femoral insertion point
4. Femoral tunnel preparation
5. Passing of the LARS™
6. Femoral fixation
Single bundle sMCL reconstruction

1. Tibial fixation

The tibial insertion point for the sMCL is identified 4-5cm distal to the joint line, proximal to the pes anserinus. Ensure that the free fibre section of the LARS™ MCL32 is aligned with the joint line of the knee prior to securing the LARS™. The flat portion of the LARS™ MCL32 is secured at the tibial insertion using a double staple technique. The first staple should be inserted over the flat portion of the LARS™ MCL32 5-10mm distally to the final desired fixation point.

2. Tibial fixation, proximal staple

The flat tail end of the LARS™ MCL32 is then folded back over the first staple and secured 5-10mm proximal with a second staple to ensure secure fixation.

Tip: After initial staple impaction, detach stapler from staples and tighten to close jaws and use end as a solidpunch to seat staple flush on bone.
3. Identification of isometric femoral insertion point

The proximal cylindrical cord end of the LARS™ is then passed superficial to the joint capsule using a curved haemostat or grasper passed down from the femoral insertion point.

The isometric femoral point is identified by drilling a sharp 2mm k-wire 2mm proximal and 5mm posterior to the medial epicondyle, aiming anterior and proximal to avoid other graft tunnels if performed as part of a multiligament reconstruction procedure. Isometry can be confirmed by wrapping the cord end of the LARS™ MCL32 around the k-wire and flexing/extending the knee through its full range of motion.

There should be minimal change in tension in the LARS™ throughout the range of motion.

If there is significant change in tension in the LARS™ ligament during flexion and extension the k-wire will need to be re-positioned and the isometry checked again.
4. Femoral tunnel preparation

Once the isometric femoral point has been identified, the sharp k-wire can be drilled through the femur aiming anterior and proximal until the lateral cortex is breached. Overdrill the k-wire with a 5mm diameter cannulated drill bit. Leaving the k-wire in place, remove the cannulated drill and insert the wire loop passing canula.

Remove the k-wire and pass a flexible wire loop through the tube so that the looped end exits the medial end of the tunnel.
5. Passing of the LARS™ ligament

Use the flexible wire loop to pass the LARS™ lead sutures through the femoral tunnel. Pull the LARS™ through the femoral tunnel, being careful to ensure that it does not become twisted and the free-fibres remain parallel. Do not overtension the LARS™.

Put the knee though full range of motion, from full flexion to full extension to ensure there is no impingement.

6. Femoral fixation

With the knee in neutral rotation, secure the LARS™ in the femoral tunnel using a 6x30mm LARS™ interference screw inserted from the medial side over a blunt guidewire. Maintain some tension on the LARS™ ligament while the screw is inserted to prevent the LARS™ being pushed into the tunnel.

Note: The LARS™ MCL32 should be fixed at its longest length to avoid over tensioning and restricting full range of movement.
Note: LARS™ recommends the use of LARS™ non-absorbable interference screws generally 1mm larger than the bone tunnel diameter, depending on bone quality, to ensure sufficient press fit. LARS™ screws are designed to minimize any damage to the reinforcement during fixation. The excess LARS™ is cut flush to the lateral bone surface using a scalpel.
Double bundle sMCL and POL reconstruction technique summary

1. Femoral tunnel preparation
2. Passing of the LARS™ ligaments
3. Femoral fixation
4. POL tibial fixation
5. sMCL tibial fixation

3. Alternative technique for femoral tunnel
In cases of grade 3 laxity or if there is posteromedial rotational instability, two individual LARS™ MCL32 ligaments can be used to reconstruct the superficial medial collateral ligament (sMCL) and the posterior oblique ligament (POL).

Expose the tibial and femoral insertion points for the superficial MCL and POL reconstructions as previously described (refer to page 4).

1. Femoral funnel preparation
Drill with a sharp k-wire through the femur from the medial epicondyle, aiming anterior and proximal to avoid tunnels for any multiligament reconstruction requirements, until the lateral cortex is breached.
Drill through the femur using a 6-7mm cannulated drill over the k-wire.
2. Passing of the LARS™ ligaments
Remove the cannulated drill and insert the wire loop passing canula through the femoral tunnel, making a lateral skin incision as necessary. Pass a flexible wire loop through the tube so that the looped end exits the medial end of the tunnel. Use the flexible wire loop to pull the leader sutures from two separate LARS™ MCL32 ligaments through the femur from medial to lateral. The free fibre section of the MCL32 should not enter the femoral tunnel.

3. Femoral fixation
Once the two LARS™ MCL32 ligaments are correctly placed in the tunnel (with 2-5mm of the woven cord section outside of the femoral tunnel) fix with a 7-9mm x 30mm LARS™ interference screw inserted from the medial side over a blunt screw guide wire.

Note: LARS™ recommends the use of LARS™ non-absorbable interference screws generally 1mm larger than the bone tunnel diameter, depending on bone quality, to ensure sufficient press fit. LARS™ screws are designed to minimize any damage to the reinforcement during fixation.
3. Alternative technique for femoral tunnel

Alternatively a blind ended tunnel, diameter 6mm and length 30mm can be created in the femur at the medial epicondyle. The cylindrical cord end of each LARS™ MCL32 is cut at 35mm from the end of the free fibre section. The LARS™ MCL32 can then be marked using a standard skin marker pen 30mm from the cut end (5mm from the free fibres). The cut cord ends of the two LARS™ MCL32 are then fed into the femoral socket until the pen mark is flush with the tunnel opening and the free fibres start 5mm outside of the femoral tunnel. Fix securely with a 7-8mm x 30mm LARS™ interference screw inserted over a blunt screw guide wire between the two LARS™ ligaments.

The distal flat ends of the LARS™ are then passed down superficial to the joint capsule using a curved haemostat or grasper passed up from the incision at the tibial insertion points.
4. POL tibial fixation
The tibial insertion for the POL is identified postero-medial on the tibia, close to the articular margin and central to the upper edge of the semimembranosus tendon. The POL is fixed first on the tibia, to bring it anterior, with the knee flexed to 30 degrees and slight external rotation applied to the tibia. The first staple should be inserted over the flat portion of the LARS™ MCL32 5-10mm distally to the final desired fixation point. The flat distal end of the LARS™ MCL32 is then folded back over the first staple and secured 5-10mm proximal with a second staple to ensure secure fixation.

Note: It is advised that the POL is reconstructed first in order to restore rotational stability and assist in MCL alignment.

5. sMCL tibial fixation
The tibial insertion for the sMCL is identified 4-5cm distal to the joint line, proximal to the pes anserinus. With the leg in neutral extension and neutral rotation the flat portion of the LARS™ MCL32 is secured using the previously described double staple technique.

Note: The LARS™ MCL32 should be fixed at its longest length to avoid over tensioning and restricting full range of movement.
The excess LARS™ is cut using a scalpel.
6. Rehabilitation

- A brace is not necessary.
- Immediate mobilization and full weight bearing.
- Immediate rehabilitation.
Ordering information

LARS™ medial collateral ligament
104.119 MCL 32

LARS™ blunt thread interference screws and staples
FST110630 Ti Cannulated Screw 6 x 30mm
FST110730 Ti Cannulated Screw 7 x 30mm
FST110830 Ti Cannulated Screw 8 x 30mm
FST110930 Ti Cannulated Screw 9 x 30mm
GST200820 CoCr staple 8 x 20mm

LARS™ MCL instrument set
204.069 5mm/2.2mm cannulated drill
204.001 LARS™ screwdriver
204.020 Ligament cutter
104.202 K-wire 2mm x 250mm - blunt end - single use
104.201 K-wire 2.5mm x 250mm 2 trocar - single use
204.014 Ligament puller handle
204.035 Staple impactor
204.036 Staple extractor
204.037 Wire loop passing canula Ø4mm
204.008 LARS™ wire loops - single use
204.902 LARS™ instrument box
204.914 MCL insert tray
References


3. LARS™ laboratory testing. Data held on file, Corin Group PLC 2005


5. Trieb et al., 2004. In vivo and in vitro cellular in-growth into a new generation of artificial ligaments. European surgical research


