

# Is ACL repair possible?

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ACL repair is one of the surgical techniques that has reinvented itself on a generational basis. Its origins go back to Mayo-Robson in 1895 where he successfully treated a knee injury in a miner by stitching back the avulsed cruciate ligament with success and good functional outcome.

Since this time however, enthusiasm has come and gone with the acquired dogma that “the ACL cannot be repaired”. More recently, there has been a resurgence of interest again in some emerging literature that it ‘may’ be repairable in a small subgroup of patients. The discussion is therefore focused on who, when and how it may be possible to repair, whether it would have healed anyway, and if there is any evidence to support this procedure.

## Why bother to look at the potential of ACL repair again?

A lot has changed since John Feagin’s study in 1972 on the outcomes of ACL repair<sup>1</sup>. This includes the advent of MRI, allowing for stratification of patients by tear type. There are distinct patterns of tear (as classified by Sherman *et al.*<sup>2</sup>) from proximal tears where the ACL is avulsed at its attachment to the medial wall of the lateral femoral condyle, to lower more disruptive mid substance tears (Figure 1). Retrospective review of MRI scans suggested that 43% may be proximal enough to allow repair<sup>3</sup>.

Arthroscopic soft tissue techniques, visualisation, instruments, and fixation devices have also developed significantly after the last 40 years, thanks to the crossover of techniques used in arthroscopic shoulder surgery.

Not all knee injuries are the same, and therefore, individualised treatment strategies may offer the best outcome for patients. It is clear from the time of injury, clinical examination, degree of instability and damage to other structures, with concomitant ACL injuries that the tear type and tissue quality are important factors.

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The degree of damage is an important factor in assessing the potential for repair of the ligament. In some tears, there is minimal damage to the bundles of the ACL and preservation of the synovial sheath. This contrasts with others where there is significant disruption and loss of the inherent fibrillar and macroscopic structure of the ligament<sup>4</sup>. Time since injury has also been found to be an important factor, with the potential for successful repair decreasing as time from the injury increases. This goes against the current accepted practice of

waiting until the knee has completely settled before embarking on surgical intervention.

ACL injuries are on the rise, particularly in young active teenagers and 20-year-olds. These are potentially high-risk patients who have increased re-rupture rates which may potentially lead to symptomatic degenerative changes at a young age.

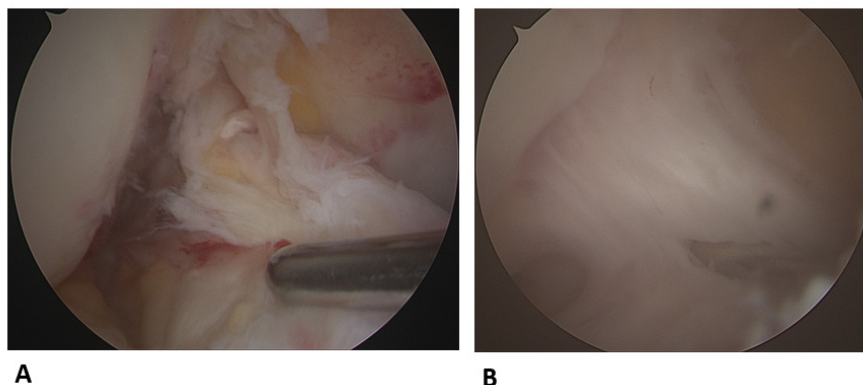


Figure 1: A: Acute femoral avulsion ACL injury. B: Healed ACL (not repaired) at arthroscopic assessment in the same patient - six months after injury.

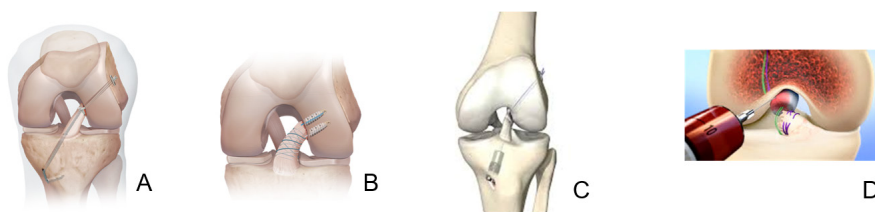


Figure 2: Four examples of methods for repairing anterior cruciate ligament tears:

- A: Primary repair using internal brace (Arthrex®).  
 B: Primary repair using Brunel suture and anchors (Arthrex®).  
 C: Dynamic Internal Stabilisation system Ligamys™ (Mathys®).  
 D: BEAR Bridge-Enhanced ACL repair (MIACH Orthopaedics, Inc.®).

ACL reconstruction has become the gold standard with successful outcomes in the majority of patients. It is often the case that there is a significant amount of preserved ligament seen within the joint which could be utilised and is excised during the procedure. This contains blood and proprioceptive fibres which may aid a healing response and be potentially repairable in some cases whilst maintaining the proprioceptive mechanisms important for knee stability.

With a move towards more personalised surgery and individualisation of treatment pathways, 'one size does not fit all', and this may allow new or redefined techniques to find a place within the scope of practice of the soft tissue knee surgeon. This has been seen with ligament stump preservation and the lateral sided augmentation procedures, which had been lost for a generation, and has now gained traction, following a reappraisal of the anatomy and modification of surgical techniques with trial evidence supporting their use in subset of high-risk patients<sup>5</sup>.

### Techniques being used for ACL repair

Different techniques for repair have emerged over the last few years (Figure 2). Some use the principle of attaching the avulsed proximal ligament back to the lateral wall 'primary repair' with differing fixation techniques.

The re-attachment has been through the use of bone anchors and a Bunnell suture within the ligament (DiFelice *et al.*<sup>6</sup>) or a pull up stirrup/cinch stitch tightened over a suspensory device on the lateral cortex (MacKay *et al.*<sup>7</sup>). Other devices allow micro-motion of the repair construct using a spring bolt mechanism (Ligamys™).

An alternative technique, which has been undertaken in a different subgroup of patients with all tear types included is the BEAR (Bridge-Enhanced ACL Repair). The BEAR procedure combines a suture repair of the ACL

with a specific extracellular matrix placed in the gap between the torn ends to facilitate ligament healing.

This research programme was undertaken by Martha Murray in Boston. The results of this phase 3 study in which the BEAR procedure is compared against hamstring ACL reconstructions as part of the RTT is currently underway, and early results have been encouraging<sup>8</sup>, with the BEAR implant receiving recent FDA approval.

Surgical techniques for ACL repair may have improved, but so has the threshold of evidence required to undertake new and adapted surgical techniques. In order for ACL repair to have a future, small cohorts of successful patients are not enough. The systematic reviews to date have led to the conclusion that there is a deficiency in the evidence. The technique needs to be assessed against the IDEAL framework (Idea, Development, Exploration, Assessment, Long-term Follow-up, Improving the Quality of Research in Surgery) of surgical interventions. Thorough assessment of the technique is required before adopting these into routine clinical practice, and this needs to include an economic assessment of costs and QALY benefit.

Early assessment and stratifications of patients with acute knee injuries has already started, with the advent of Acute Knee Clinics. These specialist clinics, as recommended within the BOAST guidelines, will allow early triage, assessment, imaging, and stratification, which may produce a sub-group of patients who would benefit from early intervention and consideration of ACL repair.

Further work is hoped towards validating this technique and early stratified intervention in acute knee injuries, with an NIHR clinical trial. ■

### References

References can be found online at [www.boa.ac.uk/publications/JTO](http://www.boa.ac.uk/publications/JTO).

### Take home messages

- Anterior cruciate ligament rupture is commonly treated with ligament reconstruction, but repair may be possible in a small sub-group of patients.
- Repair involves preservation of ACL tissue with primary repair soon after injury may, avoiding reconstruction with graft tissue.
- Surgical techniques for ACL repair have been improved benefitting from new technology and advances in arthroscopic methods.
- New evidence is required to investigate the efficacy of modern repair and a UK based trial of ACL repair is eagerly awaited.