

**ANNOTATION**

# Primary Repair of the Anterior Cruciate Ligament: A Review of Recent Literature (2016-2017)

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*Research performed at the Department of Orthopaedic Surgery, La Paz University Hospital, Madrid, Spain**Received: 02 January 2018**Accepted: 08 October 2018***Abstract**

**Background:** Anterior cruciate ligament (ACL) reconstruction using tendon or ligament autograft is the current gold standard surgical technique for acute ACL ruptures. However, ACL repair surgical procedures are reappearing as an optimistic treatment alternative for acute proximal ruptures. The purpose of this annotation is to review the current role of primary repair of the ACL.

**Methods:** A Cochrane Library and PubMed (MEDLINE) search related to the role of ACL repair in acute ACL rupture was analyzed.

**Results:** Arthroscopic ACL repair can accomplish good short-run outcomes with knee stability and resumption of sport activity in children, with proximal ACL avulsion tear. Reported results of open primary repair in adult patients with proximal tears are excellent, which ratifies there may be a possible role for primary repair as management for proximal ACL tears.

**Conclusion:** Recent reports suggest that refixation of the ACL is a possible treatment alternative in selected patients. Only time will tell whether the long-run results are similar to those obtained following ACL reconstruction.

**Level of evidence:** III

**Keywords:** ACL, Adults, Children, Repair

**Introduction**

Open primary anterior cruciate ligament (ACL) repair was the most prevalent management in the 1970s and 1980s of acute ACL ruptures. However it was abandoned because many reports showed poor results at mid-term follow-up, and because some randomized clinical trials (RCTs) reported better results after ACL reconstruction (1). ACL reconstruction using tendon or ligament autograft is the current gold standard surgical technique for acute ACL ruptures (2-4).

ACL repair surgical procedures are reappearing as an optimistic treatment alternative for acute proximal ruptures. Repair of the ACL can be carried out successfully and has the advantage of preserving the natural proprioceptive fibers of the ACL. The internal brace used will act as a secondary stabilizer following

repair, which will permit rapid rehabilitation and return to sports, while resisting injury repetition when this is plausible (2).

To create more confusion, in a systematic review reported by Monk et al, they encountered no difference between surgery and conservative management in patient-reported results of knee function at 2 and 5 years. However, Monk et al noted that many patients had unstable joints after methodical rehabilitation and decided to have surgery later on (5).

The aim of this article is to review the current role of primary repair of the ACL.

**Materials and Methods**

A Cochrane Library and PubMed (MEDLINE) search

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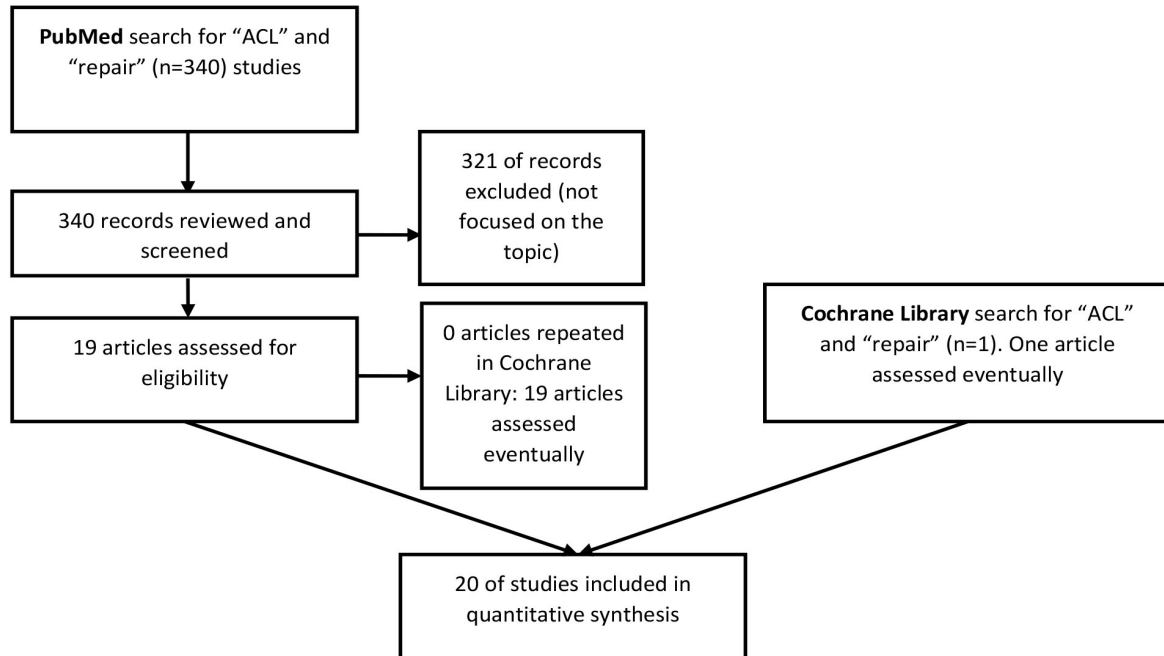


Figure 1. Flow chart of our search strategy regarding ACL repair (2016-2017).

related to the role of ACL repair in acute ACL rupture was analyzed. The main criteria for selection were that the articles were focused in the role of the role of ACL repair in acute ACL rupture. Figure 1 shows our search strategies (PubMed /Medline and Cochrane Library). The searches were made from 1 January 2016 to 31 December 2017.

## Results

The types of studies reported have different levels of evidence (levels I to IV), although most of them have level IV of evidence.

### Biomechanical Studies

In a biomechanical study on dynamic augmentation of ACL tears in 8 fresh-frozen human cadaveric knees, Häberli et al analyzed the course of translation during a simulated initial postoperative period. Their findings supported ACL repair during biological healing (6).

In other biomechanical study, van der List and Difelice investigator gap formation after primary repair of the ACL. They believed that their findings were plausible to be enough for careful early active range of motion when extrapolating from other available reports (7).

In a cadaveric study on a new ACL repair procedure Schliemann et al analyzed knee joint kinematics after dynamic intraligamentary stabilization (DIS) (8). Using a knee simulator they found that DIS with a preload of 80 N put back knee joint kinematics equivalent to that of an ACL-intact knee and was consequently able of procuring knee joint stability during ACL healing.

### Clinical Studies in Adults

Büchlet et al analyzed that functional recovery after primary ACL repair with DIS. In a series of 45 patients with acute ACL rupture they found at 1-year follow-up that the DIS procedure with adequate rehabilitation produced successful functional recovery and low rerupture rate (7%). The mean age of the series was 26 years (range 18 to 54 years) (9).

Krismer et al reported factors influencing the success of ACL repair with DIS. In a series of 264 patients they found that right patient choice and restricting of indications are needed to keep high success rates of the technique (10). Mid-substance ACL ruptures and a high pre-injury sports activity level are two predictors of worse result. When neither of the aforementioned risk factors happened the failure rate was 4%. An overall complication rate of 15% was found including 9.5% re-ruptures, 4% chronic instability, and 1.5% of more than 10° fixed flexion deformity (10).

Thirteen patients undergoing ACL repair were analyzed by Hoffmann et al (11). They performed primary single suture anchor re-fixation of ACL proximal avulsion tears. They found good to excellent clinical mid-term results. However, in cases of additional severe impairment of extensor structures or systemic rheumatic disease, loss of function and disappointing clinical outcomes happened.

### Systematic Reviews

In a systematic review on the role of internal bracing and repair of the ACL, van Eck et al stated that the

procedure may be a possible alternative in young patients with acute, proximal ACL tears. They also found that the use of internal bracing, biological augmentation, and scaffold tissue may augment the success percentage of repair (12).

In another systematic review, van der List and DiFelice encountered that tear location appears to have played a role on the results of open primary ACL repair. Results of open primary repair in patients with proximal tears were excellent, which ratifies there may be a possible role for primary repair as management for proximal ACL tears (13).

#### **Comparative Studies in Adults Repair vs. Reconstruction**

Murray et al compared 10 patients undergoing bridge-enhanced anterior ACL repair (BEAR) and 10 patients received a hamstring autograft ACL reconstruction (14). The BEAR includes suture repair of the ligament combined with a bioactive scaffold to bridge the gap between the torn ligament ends. There were no knee infections or signs of important inflammation in either group. There were no differences between groups in effusion or pain, and no failures. Magnetic Resonance Imaging (MRI) from all of the BEAR and ACL-reconstructed patients showed a continuous ACL or unbroken graft. The results of this study suggested that the BEAR technique may have a rate of complications low enough to justify a study of effectiveness in a larger group of patients (14).

In a series of 41 patients, Achtnich et al compared clinical and radiologic outcomes of primary ACL suture anchor repair and microfracturing with anatomic ACL single-bundle reconstruction in patients with acute proximal ACL avulsion tears (15). They found that proximal refixation of the ACL utilizing knotless suture anchors and microfracturing puts back knee stability and results in equivalent functional results to a control group treated with single-bundle ACL reconstruction. The outcomes suggested that refixation of the ACL is a possible treatment alternative in selected patients.

Schliemann et al compared gait pattern and early functional results between ACL repair and ACL reconstruction (16). They encountered that early functional outcomes and changes in gait pattern following DIS were comparable to those of primary ACL reconstruction. Therefore, they concluded that ACL repair may be an option to ACL reconstruction.

Van der List and DiFelice compared range of motion (ROM) and complications after primary ACL repair versus reconstruction of the ACL (17). In a series of 142 patients (90 repairs, 52 reconstructions) found that after primary repair, patients had better ROM, and trends towards fewer complications than reconstruction. Following primary repair, patients had better ROM, and trends towards fewer complications than reconstruction. Primary repair is a safe, brief procedure with early ROM and low complication rates (2% vs. 9%) and infections (0% vs. 6%). They concluded that primary repair was a secure, brief technique with early ROM and low complication rates (17).

#### **Clinical Studies in Children**

Smith et al reported a new management approach

in 3 children. Two patients (aged 5 and 6 years) with full proximal ACL ruptures and a third (aged seven) with an associated tibial spine avulsion experienced direct surgical repair, reinforced with an internal brace that was taken away after 3 months. Second-look arthroscopy, clinical examination and imaging at 3 months established joint stability and full ACL healing in all children. Normal activities were recommenced at 4 months, and excellent function was found past 2 years (18).

Bigoni et al reported the results of 5 patients aged 9 years on average who experienced suture anchor ACL reinsertion (19). Arthroscopic ACL reinsertion was carried out with bioabsorbable suture anchor. At a mean follow-up of 43 months, no re-injury and leg length discrepancies were found. All patients came back to preceding level of activity. The conclusion was that arthroscopic ACL repair can accomplish good short-run outcomes with knee stability and resumption of sport activity in children, with proximal ACL avulsion tear (19).

#### **The role of MRI in preoperative planning**

According to van der List and DiFelice, preoperative MRI can predict eligibility for arthroscopic primary ACL repair (20). The series included 63 repair patients and 67 reconstruction patients. Repair patients had more commonly type I tears (41 vs. 4%) and good tissue quality (89 vs. 12%). Preoperative MRI tear site and tissue quality predicted eligibility for primary repair.

#### **Discussion**

ACL repair procedures are re-appearing as a promising treatment alternative for acute ACL proximal ruptures. Repair of the ACL can be carried out successfully and has the advantage of maintaining the natural proprioceptive fibers of the ligament. The internal brace works as a subsidiary stabilizer following repair, which may permit rapid rehabilitation and come back to sports, while resisting injury repetition when this is plausible (2).

ACL tears are currently treated with allografts and autografts. However, Waryasz et al believe that developments in tissue engineering and biosynthetics are ameliorating ACL repair procedures. In other words, ACL repair may put forth a viable alternative for children (21).

I agree with Hohmann when he stated that the reported outcomes are promising but not different from other published series more than 25 years ago. In fact, he stated that only time will tell whether the long-run results are similar to those obtained following ACL reconstruction (22).

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