

# Minimally Invasive Surgical Procedure on a Joint

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## Abstract

A Cochrane database review found no difference in pain, complications, graft failure, and subjective knee scores at short- and long-term follow-up in patients with single- and double-bundle ACL reconstruction. However, patients with double-bundle reconstruction were better in terms of IKDC knee examination, knee stability with KT-1000, rotational knee stability, with better prevention of meniscus injury.

**Keywords:** Graft rupture; Autograft; Single and double bundle reconstruction; Clinical outcomes; Bio-absorbable screws; Posterior translation

## Introduction

A recent meta-analysis of randomized controlled trials with at least 5 year follow-up found no difference in the objective stability, subjective IKDC, Lysholm and Tegner scores, graft rupture, and osteoarthritis changes between a double- and single-bundle reconstructions. However, the meta-analysis included <300 patients from 5 studies. Hence, over the past 3 years, the enthusiasm for double-bundle reconstruction has waned. No clear scientific data exist that clarifies whether one graft is superior to the other, however, there seems to be a slow shift in choice of graft, as hamstring tendons are now used at least as often as patellar tendon as an ACL graft because there appears to be less morbidity with hamstring graft use [1]. In a meta-analysis on graft choices for ACL reconstruction which compared objective stability scores, subjective IKDC and Lysholm scores, graft failure rates and pain scores, patients with a quadriceps tendon graft had lesser graft harvest site pain than BPTB graft, and better Lysholm score than hamstring autograft, while all the other variables were similar. The rupture rates with BPTB grafts are lesser than hamstring autografts although the difference is miniscule [2]. The objective stability and clinical outcomes do not differ. Soft-tissue allografts are inferior to autografts for primary ACL reconstruction in terms of the lower IKDC score, and objective stability scores. For revision knee reconstruction autografts and non-irradiated allografts have been found to have similar objective and subjective outcome scores. Irradiation of allografts makes them an inferior choice of graft for primary and revision cases. Graft comparative rate of infection In terms of post-operative infection after ACL reconstruction, using a patellar tendon autograft has a 77% lesser incidence than hamstring autograft, and 66% lower incidence than all types of other grafts [3]. At the same time, autografts and allografts did not differ in the incidence of infections. Antero-medial portal (AM) versus trans-tibial (TT) technique A meta-analysis of randomized trials found that patients with AM technique had better subjective scores (IKDC, and Lysholm) and objective stability (Lachman's, Pivot shift, and side to side difference) as compared to TT technique. Fixation devices A Cochrane database review found very low quality evidence that bio-absorbable screws are associated with more treatment failures, including intra-operative breakage, although the subjective and objective outcome scores are similar. A meta-analysis of level one studies did not find any difference between a cortical button, cross pin, and interference screw for fixation on the femoral side for hamstring autografts. For quadrupled hamstring grafts aperture fixation led to >3 mm but <5 mm side to side difference on KT-1000 measurements and a significant increase in graft ruptures as

compared to suspensory fixation [4]. Other stability measures and patient outcome scores were similar. The rate of return to sports after a primary ACL reconstruction is 83%, with a 5.2% re-rupture rate. The reported rates of return to sports at the same level after revision ACL reconstruction is only 43%, even if 73% patients had a good to excellent subjective and objective result. In children and adolescents, the rate of return to pre-injury level of sport was 78.6% and that to competitive level of sport was 81.0%. Overall, 13% patients had graft re-ruptures, and in 14% contralateral ACL injuries were reported. Remnant sparing ACL reconstruction With the recent trend of preservation and repair in knee arthroscopy, surgeons are increasingly sparing viable ACL remnants during reconstruction. Evidence suggests that preservation of the ACL remnant is beneficial in terms of vascularity and proprioception, which may improve recovery of joint position sense, and enhances revascularization and integration of the graft. Remnant sparing may be in the form of tibial remnant re-tensioning, specific bundle reconstruction for partial ACL tears, and remnant sparing where the graft is passed through the tibial tunnel and within the remnant [5]. The most recent meta-analysis of Levels 1 and 2 studies determined that remnant sparing ACL reconstruction is not vastly superior to traditional ACL reconstruction, and there is no difference in the healing of grafts, or the overall complication rates. However, remnant sparing results in better objective stability in terms of KT 1000/2000 measurements, and better Lysholm scores. Biologics in knee ligament surgery Platelet-rich plasma (PRP), platelet-rich growth factor, and stem cells have all been used along with ACL reconstruction. The addition of the internal brace has been shown to reduce the failure rates from 13.8% to 7.4%. This technique has also been reported in three children aged 5–7 years, where the internal brace was removed at 3 months after healing. In all patients, the ACL healed on second look arthroscopy, and they returned to routine activities with results sustained at 2 years. This technique builds on the internal brace technique with the belief that traditional ACL repair fails due to cyclical loading of the repair. A polyethylene wire is fixed on the tibial side with a spring screw mechanism which holds the tibia in posterior translation

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during all degrees of movements of the knee [6]. Thus, the repair is protected leading to enhanced healing. A systematic review of 15 studies with Levels 1–5 evidence suggests that ACL repair using this technique is a safe and effective procedure in a select group of patients. The failure rates vary from 4% to 13.6%, and the revision rates varied from 2.1% to 15% at 1 year, and 7.9–11% at 2 years. The study noted that the long-term failure rates are comparable to ACL reconstruction in properly selected patients. The BEAR technique utilizes a bovine origin extracellular matrix scaffold augmentation in addition to the ACL repair to enhance healing of the torn ACL. The drawback is this technique requires a 5 cm arthrotomy. Only one human study has been done and reported good to excellent results at 2 years. Individualized ACL reconstruction Although ACL repair shows some promise, the gold standard for ACL tears remains reconstructive surgery. What is increasingly recognized is that one size does not fit all. Anatomical variations in size and shape of the bones and ligaments, along with varied patient factors and functional demands may not allow the same standardized reconstruction in every knee [7]. Hence, the concept of individualized ACL reconstruction has been proposed. The principles of this include: Appreciate the native anatomy, individualize surgery according to patient needs, place the graft in the centre of footprint, attempt to fill in about 80% of the footprint surface, and tension the grafts individually if performing a double-bundle construct. Routine notch plasty is discouraged as it may lead to bone overgrowth and impingement at a later date. Although the ideal graft, technique, fixation, and need for augmentation will continue to be debated, the following information, determined based on recent meta-analyses, may be applied to individualize ACL reconstruction. pivot shift after an ACL reconstruction [8]. Anatomic ALL reconstruction, in addition to ACL reconstruction, has been advocated in patients at high risk of ACL re-rupture, such as age <20 years, athletes engaged in pivoting sports, and patients with generalized ligament laxity. In patients with a Grade 3 pivot shift undergoing revision ACL reconstruction, an anatomic ALL reconstruction may be done to reduce the chances of failure. An alternative to ALL reconstruction is a LET which essentially involves a central band of iliotibial band being re-routed under the LCL and fixed to the tibia.[42-44] A level one study found that the addition of an extra-articular procedure decreases the pivot shift, and improves stability of the ACL reconstruction, while the subjective and objective scores remain the same. Posterior cruciate ligament (PCL) The PCL remains less controversial as compared to the ACL and there has been increased consensus in its surgical treatment. There are various approaches described for PCL reconstruction, including single- or double-bundle, TT, and tibial inlay technique [9]. A meta-analysis has demonstrated that although double-bundle reconstruction gives better objective posterior tibial stability and IKDC scores, patient reported outcomes are similar, and no technique is superior. This added stability has been postulated to be important in the long term, and hence double-bundle PCL reconstruction is preferable. Similarly, both TT and tibial inlay methods are equivalent in terms of patient reported outcomes and objective scores with the tibial inlay technique being more prone to complications. Dynamic bracing has been advised in the early phases of rehabilitation after PCL surgery. This brace offloads the PCL during deeper knee flexion angles and improves outcomes. A meta-analysis found no difference in clinical outcomes between a

single-bundle auto-graft and allograft PCL reconstruction. The patients with allograft had a longer duration of fever, higher white blood cell count, with a lower Tegner activity score, and lower objective stability scores. Much like ACL, interest has been rekindled in PCL repair and recent studies reinforce the repair with suture tape. Long-term results and further developments in this field are awaited. Multiple ligament knee injury and knee dislocations: Knee dislocation presents a unique challenge in terms of the management of soft-tissue envelope, repair, and/or reconstruction of ligaments, with their timing and technique. Although an individualized approach is recommended for these complex injuries, numerous studies have enabled a consensus and algorithm for management of these challenging injuries. The importance of the meniscus for normal knee function has been greatly appreciated in the past decade. It is increasingly recognized that it is important to repair, replace, or regenerate injured meniscus to prevent the progression of osteoarthritis. Meniscal preservation using different techniques has been shown to improve the clinical outcomes and delay degeneration.

## Conclusion

Meniscal repair can be achieved by all-inside, outside in, and inside out techniques and a variety of devices and instruments are available for the same.

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## Conflict of Interest

None.

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