



Review

The difference in clinical outcome of single-bundle anterior cruciate ligament reconstructions with and without remnant preservation: A meta-analysis



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ABSTRACT

Background: The aim of this study was to compare the clinical performance and complications between an ACL reconstruction with a remnant-preserving single-bundle technique and a standard single-bundle technique.

Methods: A search was performed of RCTs comparing the clinical outcomes and complications of ACL reconstruction with remnant-preserving and standard single-bundle techniques during October 2014. Relevant data were extracted and CONSORT was used to assess the methodological quality. Stata/SE 12.0 was used to perform a meta-analysis of the clinical outcomes.

Results: Six RCTs were included, with a total of 378 patients: 190 in the remnant-preservation technique group and 188 patients in standard-technique group. Assessing anterior stability, no difference was found between the groups for the KT arthrometer, negative rate of Lachman, and the pivot shift test. Assessing functional outcome, there was no significant difference in IKDC scores and grades or Lysholm score. In terms of complications, the percentage of tibial tunnel enlargement in the group of the remnant-preservation technique was significantly lower, despite no significant difference in the incidence of cyclops lesions.

Conclusions: The outcome of single-bundle ACL reconstruction with the remnant-preservation technique is similar to that with the standard technique in terms of anterior stability and functional recovery of the knee. Remnant preservation in ACL reconstruction decreases the percentage of tibial tunnel enlargement.

Level of evidence is II.

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1. Introduction

Arthroscopically assisted anterior cruciate ligament (ACL) reconstruction is the gold standard for treating ACL ruptures. The aim of ACL reconstruction is to restore knee stability, recover the patient's pre-injury sports capability, and prevent the occurrence of a torn meniscus and osteoarthritis [1,2]. Due to its good clinical outcome, the single-bundle technique for ACL reconstruction has traditionally been the standard treatment [3–5]. However, in recent years, double-bundle ACL reconstruction has gradually become the preferred method. In theory, the double-bundle technique is considered to be superior to the single-bundle technique for ACL reconstruction. However, the latest meta-analyses have demonstrated no significant difference in the functional recovery between the two techniques, although the double-bundle technique had a better outcome in terms of rotational laxity [6, 7]. The single-bundle technique remains the most commonly used technique in ACL reconstruction, as its clinical outcome has continuously improved with advancements [8].

The afferent neural input of proprioception is a prerequisite of neuromuscular coordination as it influences the biomechanical behavior of the knee and ACL [9]. Therefore, restoration of knee function in ACL injury depends not only on arthroscopic techniques but also on the anatomical and biomechanical factors, and the precise complex interaction between the nervous and musculoskeletal systems [10]. Mechanoreceptors that control knee proprioception are found around the ACL, most of which are located in the inner membrane of the synovium near the tibial attachment of the ACL. They maintain knee stability by stimulating coordinated muscular contractions [11,12]. Mechanoreceptors can still be found in remnants of injured ACLs: Georgoulis et al. reported that residual mechanoreceptors could still be found in the stump of a ruptured ACL, attached to the posterior cruciate ligament,

three years after ACL rupture [13]. For this reason, remnants should be preserved as much as possible, even in chronic injuries. Lee et al. found that even with 20% of the ACL remnant, most mechanoreceptors could provide relatively good proprioception [14]. Furthermore, retaining the stump could accelerate the revascularization and synovial coverage of the reconstructed ligament [15]. Therefore, it can be concluded that preserving the remnant can re-establish proprioception in the reconstructed ACL and accelerate functional recovery. Although recent studies [9,16–19] have demonstrated good clinical outcome with remnant-preserving single-bundle ACL reconstruction, some investigators have found that remnant preservation may increase the risk of certain complications and subsequently affect the functional performance of the knee [20–22].

Although a recent systematic review concluded that remnant preservation has some advantages over the standard technique [23], the studies included in the review were mostly retrospective, and the data were not pooled for evaluation of the clinical outcome. To overcome these drawbacks, in the present meta-analysis, only prospective, randomized, controlled trials (RCTs) were included and the data for clinical outcome were pooled to compare the clinical outcomes between the remnant-preserving and standard single-bundle technique.

2. Materials and methods

2.1. Searching strategy

Two researchers independently searched international databases from 1966 to October 2014, including: PubMed, Embase, the Web of Science, and the Cochrane central database. There was no restriction to specific languages or years of publication. A manual search of all reference lists contained in the literature was also performed. Search terms used for the PubMed search are presented in Table 1. In addition, OpenGrey, the World Health Organization International Clinical Trials Registry Platform, the International Standard Randomised Controlled Trial Number (ISRCTN) registry, and Current Controlled Trials were searched to review the trial registry and grey literature.

2.2. Inclusion and exclusion criteria

Inclusion criteria were as follows: [1] subject – all adult patients who underwent arthroscopy-assisted ACL reconstruction, with no limitation to sex and race; [2] intervention method – arthroscopy-assisted single-bundle ACL reconstruction and comparison of clinical outcome between the standard and remnant-preservation technique; [3] outcome parameters – pivot shift test, Lachman test, KT1000/2000 arthrometer, International Knee Documentation Committee (IKDC) scores, Lysholm scores, and complications, including cyclops lesions and tibial tunnel enlargement; and [4] study type – RCT.

The exclusion criteria were: [1] non-prospective trials (e.g., retrospective studies, observational studies, case series, and reviews); [2] animal or cadaver studies; [3] comparisons that were not between standard and remnant preservation in ACL reconstruction; and [4] studies with <1 year of follow-up.

Table 1

PubMed search strategy.

| |
|--|
| #1 Anterior cruciate ligament [mesh] |
| #2 ACL [title/abstract] |
| #3 Anterior cruciate ligament [title/abstract] |
| #4 #1 OR #2 OR #3 |
| #5 Reconstructive surgical procedures [mesh] |
| #6 Arthroscopy [mesh] |
| #7 Reconstructive surgical procedures [title/abstract] |
| #8 Arthroscopy [title/abstract] |
| #9 Joint instability [title/abstract] |
| #10 Tendon transfer [title/abstract] |
| #11 Transplantation [title/abstract] |
| #12 Transplants [title/abstract] |
| #13 Grafts [title/abstract] |
| #14 #5 OR #6 OR #7 OR #8 OR #9 OR #10 OR #11 OR #12 OR #13 |
| #15 Remnant [title/abstract] |
| #16 Debridement [title/abstract] |
| #17 Stump [title/abstract] |
| #18 #15 OR #16 OR #17 |
| #19 Randomized controlled trial [publication type] |
| #20 Randomized controlled trials as topic [mesh] |
| #21 Random* [title/abstract] |
| #22 #19 OR #20 OR #21 |
| #23 #4 AND #14 AND #18 AND #22 |

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