



Single-bundle or double-bundle for anterior cruciate ligament reconstruction: A meta-analysis



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ABSTRACT

Purpose: To compare the clinical outcomes of anterior cruciate ligament (ACL) reconstruction with double-bundle and single-bundle techniques.

Study design: Meta-analysis

Methods: We searched electronic databases including PubMed, Embase, Cochrane Central Register of Controlled Trials, and Google Scholar from 1966 to Jan 2012 to identify randomized controlled trials (RCTs) comparing clinical outcomes of anterior cruciate ligament (ACL) reconstruction with double-bundle and single-bundle techniques. Two reviewers independently extracted data and assessed trial quality. Meta-analysis was performed to pool results.

Results: Nineteen RCTs were included with a total of 1686 patients. The pooled analysis across all studies showed that the double-bundle ACL reconstruction technique could have significantly better outcomes in rotational laxity, as assessed by the pivot-shift test, KT grading and IKDC grading than the single-bundle techniques. We found no evidence of a difference in function measured by IKDC scores, KT arthrometer, Lysholm knee, or Tegner activity scores and complications after operations between single and double-bundle ACL reconstruction groups.

Conclusion: Our meta-analysis demonstrated the superiority of double-bundle over single-bundle anterior cruciate ligament reconstruction. The double-bundle ACL reconstruction technique has better outcomes in rotational laxity (pivot-shift test, KT grading and IKDC grading). However, for functional recovery, there was no significant difference between single-bundle and double-bundle reconstruction techniques.

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1. Introduction

The anterior cruciate ligament (ACL), in addition to its primary role restraining anterior tibial translation, has been shown to contribute to rotational stability of the knee [1]. Anatomical and biomechanical studies have characterized that normal ACL can be divided into two bundles, anteromedial (AM) and posterolateral (PL) [2]. And each appears to function at different angles of flexion of the knee, together providing responsibility for the stability of the joint [3]. Anterior cruciate ligament disruption is a common cause of anterior knee instability, particularly as a result of sports activities. The arthroscopic single-bundle (SB) technique has been the gold standard for ACL reconstruction and showed good results over the past decade. However, a failure rate of 11–30% is reported in the literature with persistent instability of the knee, especially in rotational stability as revealed by a positive pivot shift test result [4,5]. In order to overcome these limitations of the single-bundle ACL reconstruction technique, the double-bundle (DB) reconstruction technique was proposed as a method to anatomically replicate both

the anteromedial and the posterolateral bundles [6]. Anatomic double-bundle reconstructions are able to more closely restore normal kinematics to the knee when compared with a single-bundle technique in a cadaver model [7]. But these reports were based mainly on experimental studies that did not consider the biological healing process. Consequently, clinical results of the double- and single-bundle techniques are still controversial. Some studies show benefits of the double-bundle technique in AP and rotational laxity [8–10], whereas other studies report different conclusion [11,12]. Furthermore, there were two meta-analyses published in 2008 and 2012 respectively, “and no accordant conclusion was reported” in the two studies [13,14]. Moreover, more RCTs have been published recently. The purpose of this meta-analysis is to compare the outcome of single-bundle versus double-bundle reconstruction of the ACL.

2. Materials and methods

2.1. Criteria for considering studies for this review

2.1.1. Studies included

We included randomized controlled trials with a follow up of at least two years.

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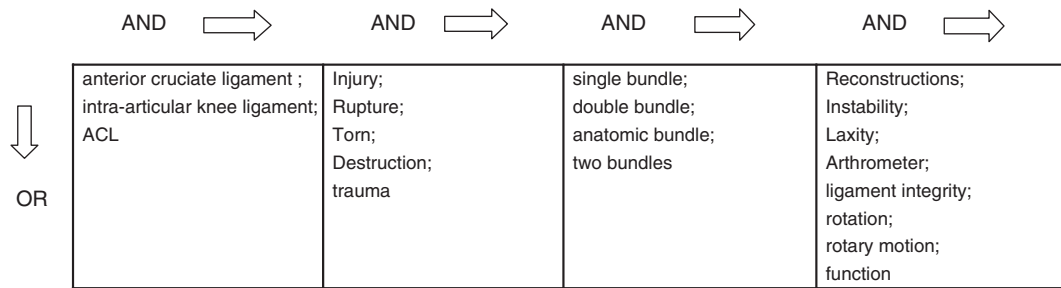


Fig. 1. Keywords and boolean (logical) operators used in the database searches.

2.1.2. Types of participants

The study population included adults who underwent ACL reconstruction.

2.1.3. Types of interventions

All patients underwent single or double-bundle ACL reconstruction. And only the appropriate comparisons between single-bundle vs double-bundle reconstructions were selected.

2.1.4. Types of outcome measures

Outcome measures included pivot-shift test, anterior laxity by KT1000/2000 arthrometer, and functional outcome by Lysholm, International Knee Documentation Committee (IKDC). Other outcomes such as Lachman test, Tegner scores, and complications also were considered.

2.2. Search strategy for identification of studies

All relevant RCTs meeting the inclusion criteria were identified by the following: We searched the PubMed, Embase, Cochrane Central Register of Controlled Trials, and Google Scholar databases. Two authors independently searched for relevant studies in any language from 1966 to

Jan 2012. The search strategy was created with the assistance of a librarian using a combination of terms including anterior cruciate ligament, intra-articular knee ligament; injury, rupture, torn, destruction, trauma; single bundle, double bundle, anatomic bundle, two bundles; reconstructions, instability, translation, laxity, arthrometer, ligament integrity; rotation, rotary motion, pivot-shift; and function, Lysholm, IKDC, KOOS, Tegner. We limited searches to randomised controlled trials, systematic reviews, and meta-analyses and imposed no language or other limitations. The electronic search was complemented by the following hand searching the reference lists. Fig. 1 gives details of the search strategy.

2.2.1. Selection of studies

Two reviewers (Li and Ning) independently screened the titles and abstracts of studies identified by the search strategy and discarded clearly irrelevant studies. The same two reviewers also independently applied the selection criteria to the studies retrieved by the literature search. They discussed to resolve any disagreement; if any uncertainty remained, they consulted further reviewer and expert (Feng) to decide.

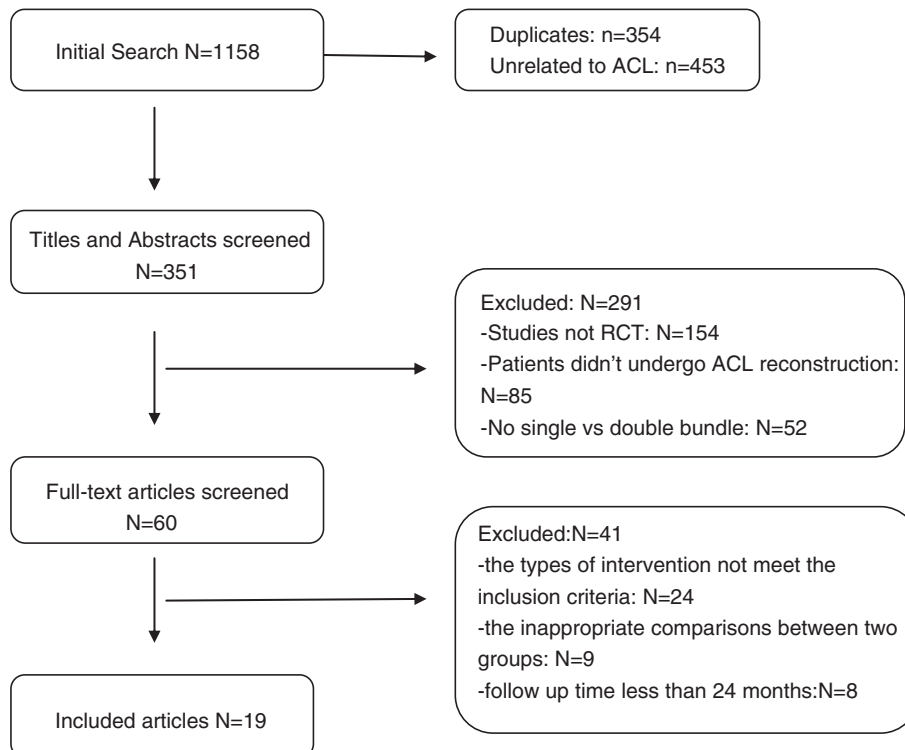


Fig. 2. Flowchart of trials selection process.

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