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# Mechanical failures in ACL reconstruction: a systematic review of randomized controlled trials comparing BTB and HT autografts

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## ADMINISTRATIVE INFORMATION

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**Review Stage at time of this submission -** Completed but not published.

**Conflicts of interest -** None declared.

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**Amendments -** This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 24 September 2025 and was last updated on 24 September 2025.

## INTRODUCTION

**Review question / Objective** Using a PICOS approach, to compare mechanical failures after primary arthroscopic ACL reconstruction using bone–patellar tendon–bone (BTB) versus hamstring tendon (HT) autografts. Primary outcome: graft failure (rupture/revision or traumatic re-injury). Secondary outcomes: objective laxity (KT-1000/Lachman/pivot-shift), pain (anterior knee pain), and patient-reported function.

**Rationale** ACL injuries are frequent in pivoting sports and reconstruction is commonly performed with BTB or HT autografts. Although functional results are often similar, potential differences in mechanical failure and morbidity may guide graft choice. Evidence is heterogeneous in how “failure” is defined; this review synthesizes RCT evidence focusing on failure events and stability.

**Condition being studied** Anterior cruciate ligament (ACL) injury requiring primary surgical reconstruction.

## METHODS

**Search strategy**
Database: PubMed.
Search string:
(anterior cruciate ligament OR ACL OR ligamento cruzado anterior) AND (reconstruction OR repair OR arthroscopy OR artroscopia) AND (patellar tendon OR BTB OR tendão patelar) AND (hamstring tendon OR STG OR tendão isquiotibial) AND (failure OR mechanical failure OR rupture OR re-rupture OR revision OR falha OR re-ruptura)
Filters applied: last 10 years; Clinical Trial; Randomized Controlled Trial. Hand-screening of references where relevant.

**Participant or population** Adults undergoing primary arthroscopic ACL reconstruction.

**Intervention** BTB autograft ACL reconstruction (including single- or double-bundle where applicable).

**Comparator** HT autograft ACL reconstruction (including standard 4-strand and modified 6-strand constructs).

**Study designs to be included** Clinical trial e randomized controlled trial.

**Eligibility criteria** Included in the review were studies that performed a direct comparison between patellar tendon (BTB) and hamstring tendon (HT) grafts in patients undergoing primary arthroscopic ACL reconstruction, which reported rates of mechanical failure, such as re-rupture, reoperation or laxity, including randomized clinical trials (RCTs) or comparative observational studies published in the last 10 years, in English or Portuguese. Articles that evaluated only one type of graft, narrative reviews, letters to the editor or editorials, as well as studies that included synthetic grafts or that exclusively analyzed ACL revision surgeries were excluded.

**Information sources** Electronic database: PubMed only. No trial registries or grey literature were searched.

**Main outcome(s)** Mechanical failure events: graft rupture, revision surgery, or traumatic re-injury; objective laxity where reported (KT-1000/Lachman; pivot-shift). Effect measures: risk (%) and counts per arm; narrative synthesis due to heterogeneity.

**Additional outcome(s)** Anterior knee pain/ “kneeling pain”; patient-reported outcomes; return to sport.

**Data management** Two independent reviewers performed blinded screening of titles/abstracts (n=77 → 13 after filters). Disagreements resolved by a third reviewer. Full-text review (n=6) with 1 exclusion for heterogeneity; 5 RCTs included. Data extracted to a structured spreadsheet; PRISMA flow documented. Duplicate cohort (Mohtadi 2016/2019) treated as a single population for pooled counts.

**Quality assessment / Risk of bias analysis** No formal risk-of-bias tool was applied; trials were summarized qualitatively. Limitations: (i) lack of standardization in the definition of “failure” (preventing separate analysis of structural vs. non-structural failures); (ii) technical heterogeneity (double beam, 6 wires, graft type, fixations) and rehabilitation heterogeneity; (iii) few events and moderate samples, limiting accuracy.

**Strategy of data synthesis** Narrative synthesis. Descriptive statistics of failure rates by graft type; figures/tables summarize event counts and percentages. No meta-analysis due to varied definitions of failure, different graft constructs (e.g., HT 6-strand, double-bundle), and mix of autografts/allografts.

**Subgroup analysis** Planned/considered: (i) autograft vs allograft trials; (ii) graft construct (HT 6-strand vs standard); (iii) longer (≥5y) vs shorter follow-up; (iv) age/athletic cohorts where available.

**Sensitivity analysis** Exclude (a) trials using allografts; (b) duplicate cohort time-points (retain longest follow-up); (c) studies with <3 years follow-up in long-term summaries.

**Language restriction** Yes. English and Portuguese publications considered.

**Country(ies) involved** Brazil and Ivory Coast.

**Keywords** Anterior cruciate ligament; ACL reconstruction; bone-patellar tendon-bone; hamstring autograft; graft failure; randomized controlled trial; mechanical failure.

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