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Autograft versus Allograft Failure in Anterior Cruciate Ligament Reconstruction of Young Athletic Patients

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Introduction

ACL ruptures are common injuries in young male and female athletes. It is predicted that 3.24 per 100 men and 3.51 per 100 women will rupture their ACL during his or her 4 years as a collegiate athlete (Pallis et al.). The only treatment for an ACL rupture is surgical reconstruction using a graft - either an autograft, from the patient's own tissues, or an allograft, tissue donated from a human cadaver. Re-ruptures are not uncommon and there is a clinical debate as to whether the type of graft used for ACL reconstruction contributes to graft failure.

Due to a lack of definitive evidence, this study aims to compile and investigate whether autograft or allograft tissues are associated with an increased incidence of graft failure.

This study defines graft failure by patient reported symptoms (subjective findings), knee stability and integrity (objective findings) and graft rupture (rupture and predicted ruptures).

International Knee Documentation Committee (IKDC): qualitative questionnaire examining subjective assessment, symptoms, range of motion and ligament examination of the reconstructed ACL

Tegner Lysholm Knee Scoring Scale (TLKS): assesses temporal responsiveness to evaluate early return to function after ACL reconstruction

Anterior Drawer Test: examines ACL integrity

Lachman Test: a more sensitive measurement of ACL integrity (gold standard)

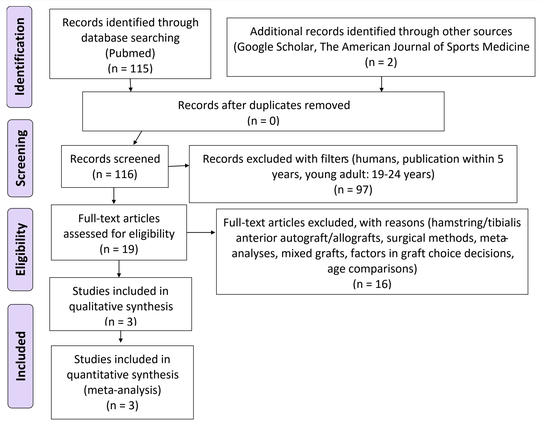
Pivot Shift Test: tests stability of the knee

Case: AB is a 21 year old male college basketball player who recently injured his knee during practice. The school's athletic physician is suspicious of an ACL rupture and has referred AB to an orthopedic surgeon. The surgeon recommends ACL reconstruction and has given AB the choice of using either an autograft or an allograft. AB's primary concern is being able to play in his senior season next fall. He doesn't know which graft choice is best to get him back on the court.

P	Population	Young Active Patients
I	Intervention	Autograft
C	Comparison	Allograft
O	Objective	Graft Failure

Clinical Question: Does the type of graft, autograft versus allograft, contribute to graft failure in ACL reconstruction in young active patients?

Methods



Results

Study 1: Survival Comparison of Allograft and Autograft Anterior Cruciate Ligament Reconstruction at the United States Military Academy

Objective: To compare the rate of failure between autograft and allograft reconstruction in young, athletic patients.
Study Design: Prospective Cohort Study.
Results: Cadets who received an allograft tendon were 7.7 times more likely to experience graft failure compared to those who received an autograft tendon.
Study Critique: Different surgeons, small degree of dropout, male predominant study, no way of determining fixation device or tunnel positions due to lack of imaging studies, type of allograft sterilization is unknown.

Study 2: Difference in Graft Maturity of the Reconstructed Anterior Cruciate Ligament 2 Years Postoperatively: A Comparison Between Autografts and Allografts in Young Men Using Clinical and 3.0-T Magnetic Resonance Imaging Evaluation

Objective: To compare graft maturity between allograft tendons and autograft tendons at two years postoperatively.
Study Design: Cohort Study.
Results: All participants returned to normal sports activities and regained full strength and stability. No difference was seen in subjective scores, physical examination, or graft orientation and width at the distal, proximal and middle sites. Allograft SNQ values were significantly higher than the autograft SNQ values at the distal, proximal and middle sites.
Study Critique: Two different types of fixation tools were used (Endobutton CL and Rdgidfix cross pins), no females included in the study, activity levels of participants are unconfirmed, small sample size (52 participants).

Study 3: Bone-Patellar Tendon-Bone Autograft Versus Allograft in Outcomes of Anterior Cruciate Ligament Reconstruction

Objective: To compare BPTB autografts to allografts for ACL reconstruction, specifically with regard to patient satisfaction, return to preinjury activity level, and postoperative functional outcomes.
Study Design: Meta-analysis.
Results: Outcomes on subjective IKDC and TLKS were significantly in favor of autografts. Return to preinjury activity and pivot shift were significantly in favor of allografts. Although allograft BPTB demonstrated a 3-fold increase in re-rupture rates compared with autograft.
Study Critique: Includes non-comparative studies in order to increase the amount of data, varying follow-up time within each study, study hypothesis does not match the tone of the paper.

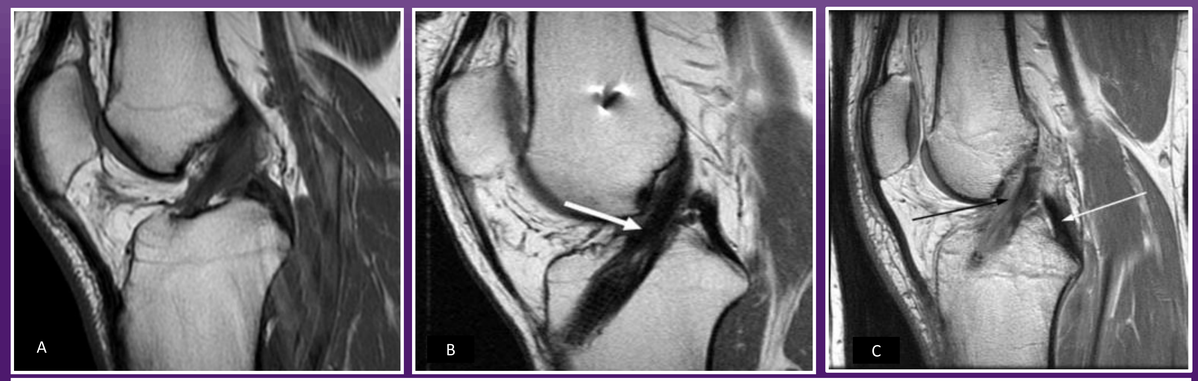


Figure 1: MRI images of three different knees. A. Native ACL with low signal. B. Reconstructed ACL with low signal (white arrow). C. Reconstructed ACL with increased signal (black arrow) compared to native PCL with low signal (white arrow). http://www.boneandjoint.org.uk/content/jbjsbr/89-B/9/1165.full.pdf - http://radsource.us/acl-graft-tear/ - http://images.radiopaedia.org/images/1552947/af6782009f8b5dc4bdee8969e87f52.jpg

Table 1: Compiled Subjective, Objective, and Rupture Data of the Three Reviewed Studies

	Pallis et al. (Study 1)	Li et al. (Study 2)	Kraeutler et al. (Study 3)
Number of patients	122	52	5182
Average Follow Up	1, 2, and 3 years	2.5 years	2-13 years
International Knee Documentation Committee (IKDC)	Not enough individual scores recorded for statistical analysis	No difference (p=0.65)	Favors Autograft
Tegner Lysholm Knee Scoring Scale (TLKS)	Not enough for statistical analysis	No difference (p=0.5436)	Favors Autograft
Return to Previous Activity Level	100% of matriculating cadets meet entrance military fitness standards	100% of participants returned to normal sports activities	57.1% autograft patients and 68.3% allograft patients returned to preinjury activity level
Anterior Drawer Test (ADT)	N/A	Auto: 100% Grade 0-1 Allo: 100% Grade 0-1	N/A
Lachman Test	Auto: 98% Grade 0-1 Allo: 91% Grade 0-1	Auto: 100% Grade 0-1 Allo: 100% Grade 0-1	N/A
Pivot Shift Test	No gross pivot shifts in both autografts or allografts	N/A	Favors allograft
Ruptures and predicted ruptures (Higher SNQ on MRI)	12.3% Autografts 43.8% Allografts	Allografts have a higher predicted rupture rate (p<0.05)	4.3% Autografts 12.7% Allografts

Conclusion

Our analysis of autograft vs. allograft tissues revealed:

- No significant difference in subjective functional examinations
  - IKDC
  - TLKS
- No significant difference in patient's ability to return to previous activity level
- No significant difference in stability or integrity on physical exam
  - ADT
  - Lachman
  - Pivot Shift
- There is a significant difference in re-rupture rate suggesting a higher incidence of re-rupture with allograft tissues used in the reconstruction of the ACL

Limitations and Future Studies

- Male patient predominant
  - Add female patients
  - Investigate hormonal influence on graft maturity and remodeling
- Small sample size, autograft predominance
  - Increase sample size
  - Increase allograft participants
- Increased decision to use autograft tendons by surgeons and patients
  - Supported by our findings
  - More research could be done to compare different autograft tendons (BTPB, hamstring autografts)

Clinical Recommendations

AB is a young college athlete with a ruptured ACL who needs to be able to play at his full capacity next year. It is important that he receives the type of graft that will provide him with the most stability and least chance of re-rupture.

Based on our analysis, we recommend that AB receive autograft tissue for his ACL reconstruction. This type of graft has been shown to be associated with equivalent patient satisfaction and measurements of knee stability and integrity on physical exam as well as a decreased rate of re-rupture.

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