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Title: Elevated Posterior Tibial Slope is Associated with Anterior Cruciate Ligament Reconstruction Failures: A Systematic Review and Meta-Analysis

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- **Availability of data and material:** Data is available upon request
- **Compliance with Ethical Standards:** Systematic review and meta-analysis conducted using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines.



Background

- Anterior cruciate ligament (ACL) ruptures are among the most common injuries in young athletes, with the incidence of ACL reconstructions in the United States increasing from 32.9 cases per 100,000 individuals in 1994 to 74.6 per 100,000 in 2014¹
- ACL reconstruction (ACLR) often leads to good outcomes, but re-injury rates can be as high as 25% in high-risk populations²
- Reasons for ACLR failure are multifactorial
- Elevated posterior tibial slope (PTS) has been identified as a risk factor for ACL injury³



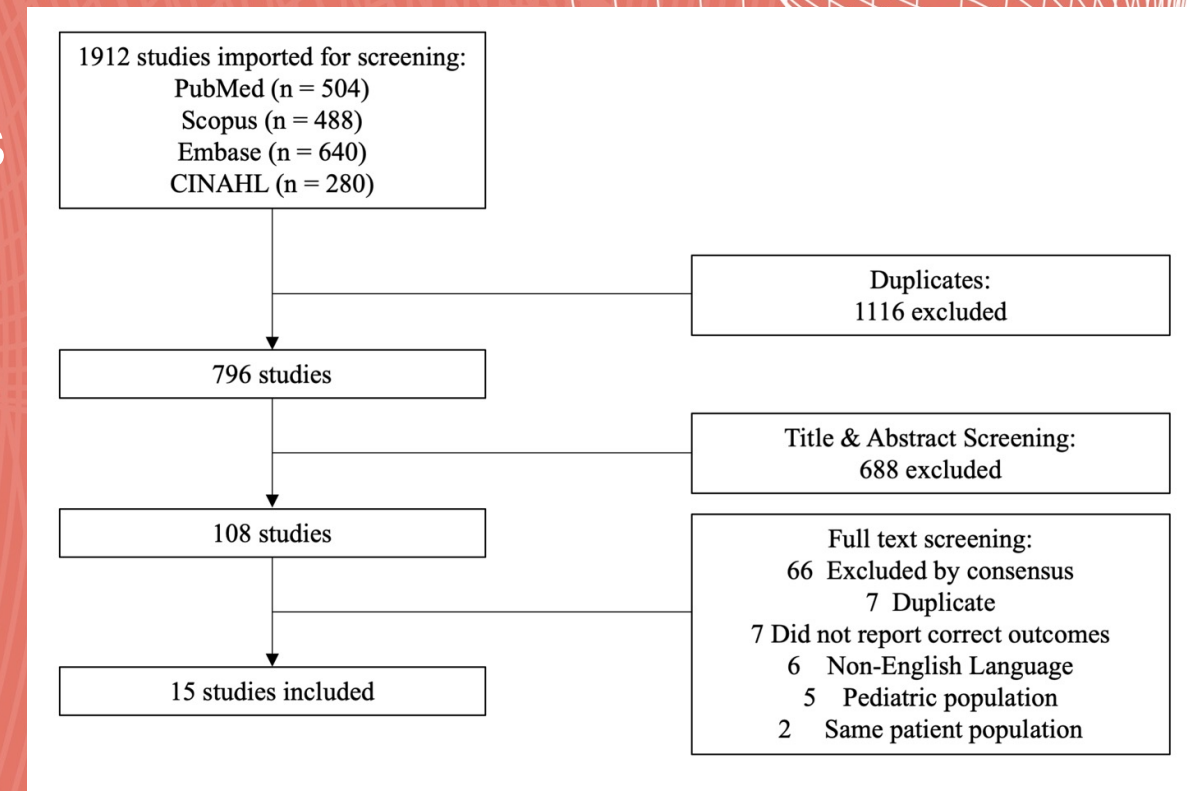
Background (cont'd)

- Our systematic review with meta-analysis aimed to identify studies that compared one or more measures of PTS between patients who experienced ACL graft failure or underwent revision ACL reconstruction (failures) versus those who had successful primary ACL reconstruction (control)
- Hypothesis: Patients who experienced ACL graft failure would demonstrate increased PTS compared to controls



Materials & Methods

- Search conducted via PRISMA guidelines utilizing PubMed, Embase, Scopus, and CINAHL through March 1, 2021
- Inclusion criteria:
 - Level III or greater, skeletally mature patients (>16 and/or physeal closure)
- Exclusion criteria:
 - Cadaveric & technique studies
 - Non-human studies
 - Studies without ACL-injured population



Results

Most important finding: Higher medial and lateral PTS measured on radiographs and MRI are associated with higher rates of ACLR graft failure



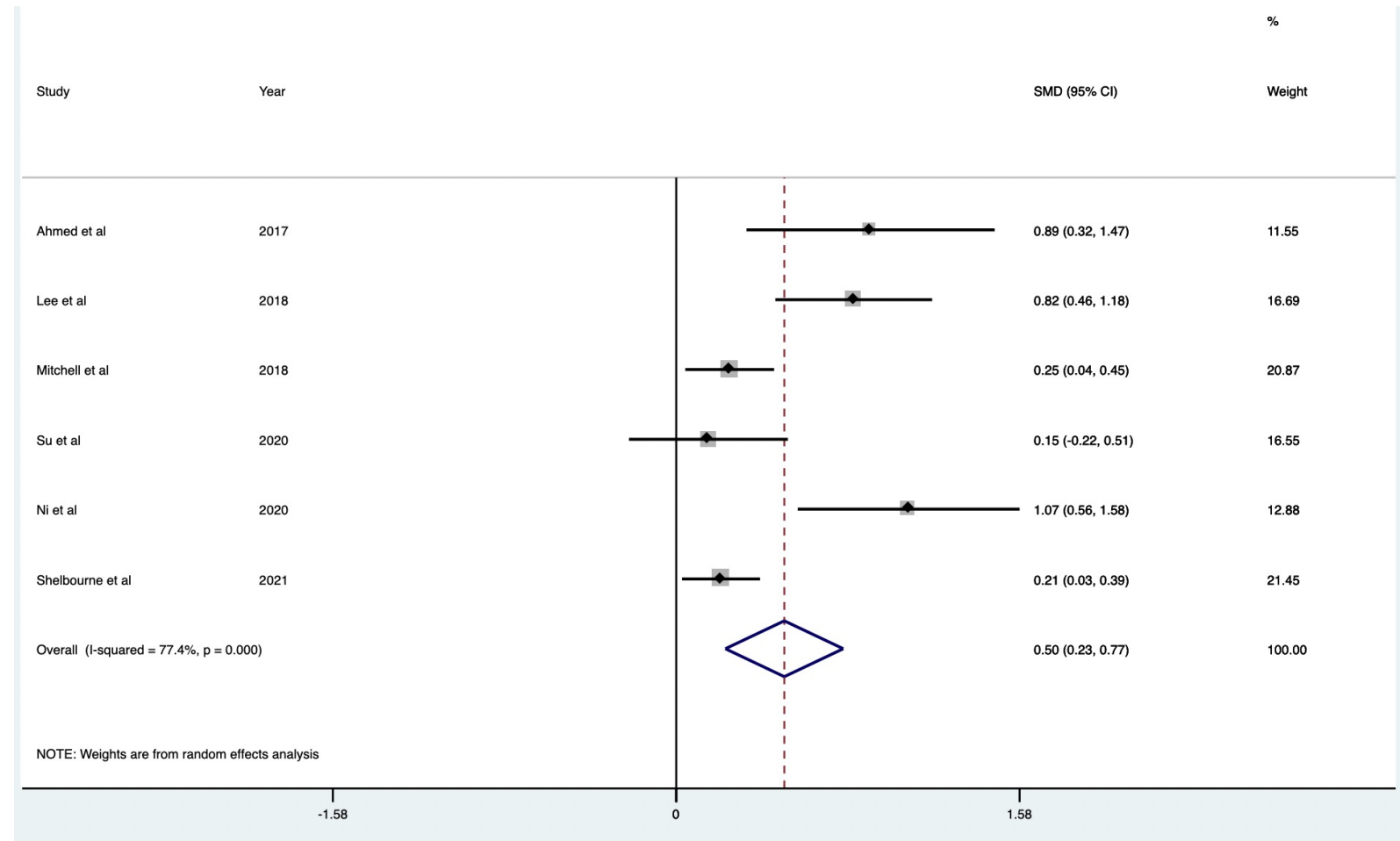
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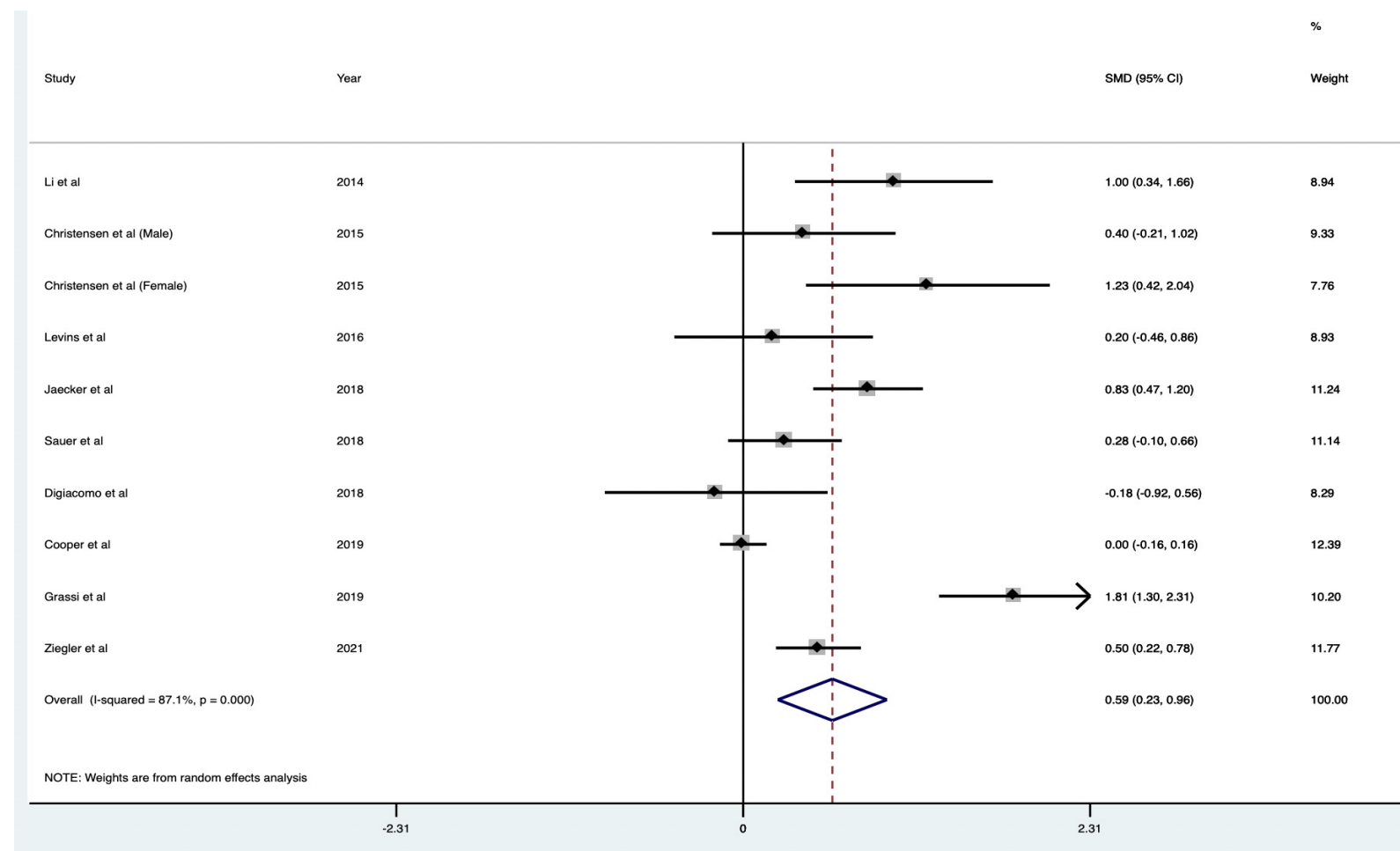
Results – Radiographic Medial PTS

- 6 studies evaluated radiographic medial PTS (comparing patients who failed and did not fail ACLR).
- Patients who failed ACLR had higher medial posterior tibial slopes compared to those patients who did not fail ACLR (SMD, 0.50; 95% CI 0.23, 0.77; $P < .0001$).



Results – MRI Lateral PTS

- 9 studies evaluated lateral posterior tibial slope on MRI (comparing patients who failed and did not fail ACLR).
- Patients who failed ACLR had higher lateral posterior tibial slopes compared to those patients who did not fail ACLR (SMD, 0.58; 95% CI 0.13, 1.03; $P= 0.012$)



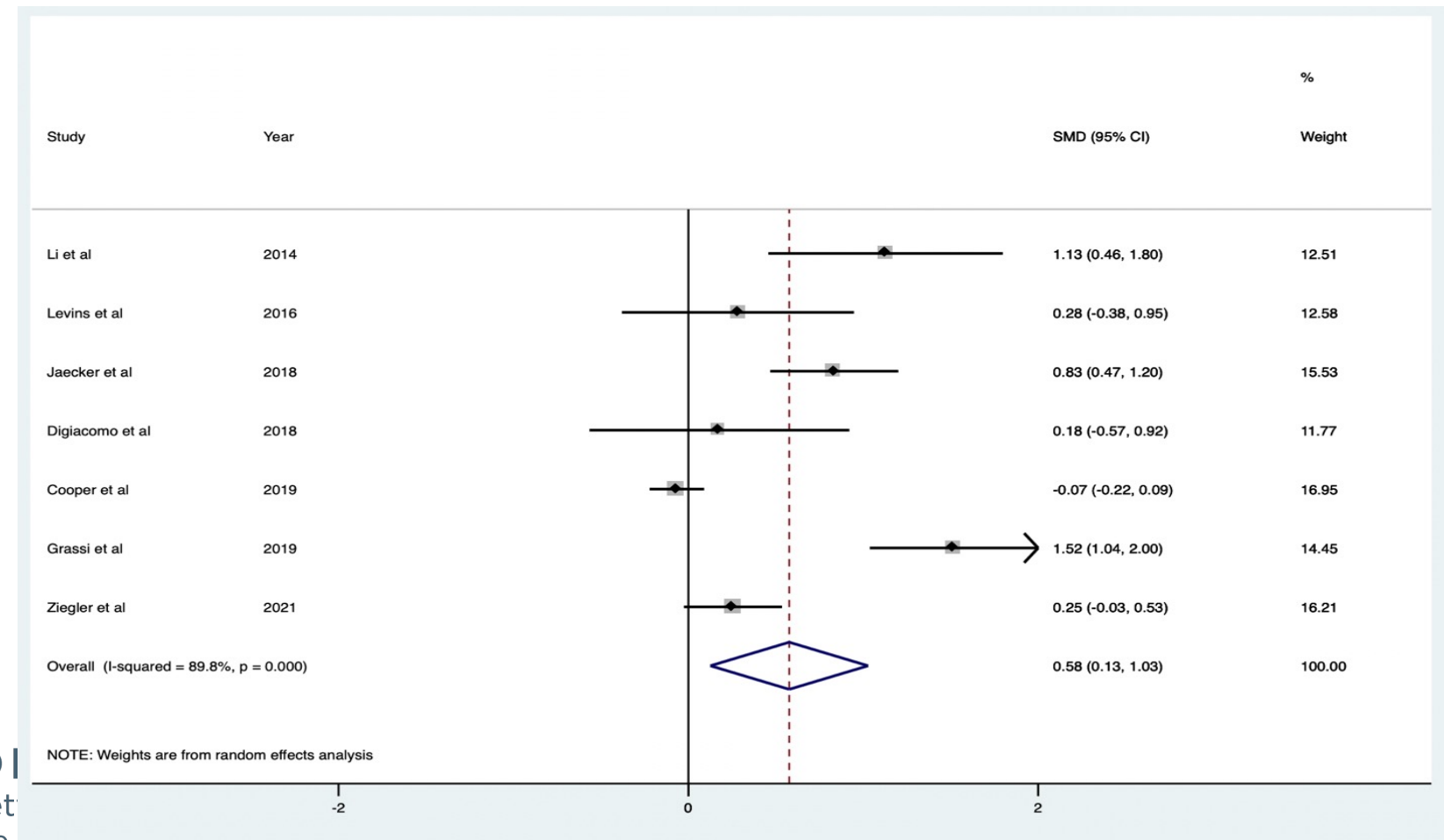
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Results – MRI medial PTS

- 7 studies evaluated medial posterior tibial slope on MRI (comparing patients who failed and did not fail ACLR).
- Patients who failed ACLR had higher medial posterior tibial slopes compared to those patients who did not fail ACLR (SMD, 0.58; 95% CI 0.13, 1.03; $P= 0.012$).



Conclusions

- Patients with elevated PTS on radiographs and MRI are at increased risk for ACL graft failure after primary ACL reconstruction
- While it has been shown biomechanically that increased posterior tibial slope increases the load within the ACL, this study adds to the growing body of evidence that elevated PTS as a clinical risk factor for graft re-tear following ACL reconstruction
- Identification of at-risk patients at time of primary ACLR can help if considering adjunctive procedures, such as lateral extra-articular tenodesis, anterolateral ligament reconstruction, or slope-reducing osteotomy to reduce failure rates in patients with elevated PTS
- Further prospective studies are needed to confirm these findings



Thank You!



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