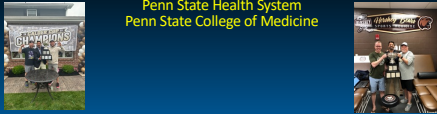


Advancements in the Management of Knee Instability


Aman Dhawan MD
Professor
Department of Orthopaedics and Rehabilitation
Penn State Health System
Penn State College of Medicine



PennState Health Penn State Orthopaedics

1

ACL Reconstruction:
Role of Extra-articular Procedures



PennState Health Penn State Orthopaedics

2

Disclosures


Paid Consultant: Smith & Nephew, Avenue Therapeutics
Research Funding: U.S. Department of Defense, NIH, Revotek Inc, Smith & Nephew
Arthroscopy Journal Associate Editor
AJSM Principal Reviewer
OJSM Editorial Board
AANA Research Committee
AOSSM Publications Committee

PennState Health Penn State Orthopaedics

3

Why are we even talking about this?


Primary ACL Reconstructions do for the most part very well...



4

ACL Outcomes


- RTS: 50% - 80% – approx. 65% are at pre-injury level
- Re-injury: 30% risk of 2nd ACL injury (ipsi- or contra-lateral) within 2 year after RTS in athletes <25 years old
 - 21% contralateral
 - 9% ipsilateral
- OA: 20% - 55% within 10-20 years
- Persistent laxity, especially rotational, on objective knee testing in approx. 40%



5


ACL Reconstruction

- Multiple iterations of grafts:
 - Allograft = 4X higher risk of failure
 - Autografts
 - Patellar Tendon/Quads/Hamstrings
 - Patellar tendon slightly lower risk of failure compared to hamstrings (2.8% vs 2.84%) in 47,613 ACLR - CORR 2017
 - Quads graft – Similar patient reported outcomes, slightly lower donor site morbidity, slightly higher rerupture rate - KSSTA 2020
- Various iterations of surgical techniques
 - Femoral independent vs Transibial – No differences in outcomes or revision rates - AJSM 2013, OJSM 2021



6

Why can't we figure this out?



PennState Health Penn State Orthopaedics

7

Maybe we don't really understand the injury...

High grade anterolateral knee laxity is not just an ACL injury

Prevalence and Classification of Injuries of Anterolateral Complex in Acute Anterior Cruciate Ligament Tears
Andrea Ferrenti, M.D., Edoardo Monaco, M.D., Mattia Fabbrì, M.D., Barbara Maestri, M.D., and Angelo De Carlo, M.D. *Arthroscopy* 2017

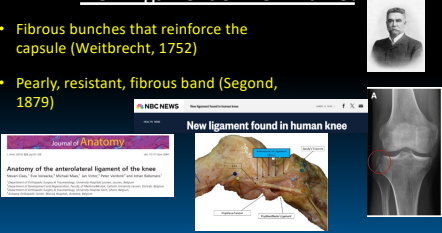
- Macroscopic tears of the lateral capsule were clearly identified at surgery in 54 of 60 patients
- Type I: 19/60 Type II: 16/60 Type III: 13/60 Type IV: 6/60
- In all cases, repair resulted in a marked reduction or apparent disappearance of the pivot-shift phenomenon
- Positive correlation between lesions of the lateral compartment and a pivot shift graded 2 or 3

PennState Health Penn State Orthopaedics

8

Anterolateral Ligament: New Ligament or New Name?

- Fibrous bunches that reinforce the capsule (Weitbrecht, 1752)
- Pearley, resistant, fibrous band (Segond, 1879)



PennState Health Penn State Orthopaedics


9

Anterolateral Ligament (ALL)

- There's still a lot of debate

- Is this New?
- Does it Really Exist?
- What does it do?
- How do we treat?



 PennState Health
 Penn State Orthopaedics

10

Anatomy/Biomechanics Summary


The Anterolateral Ligament of the Knee: An Updated Systematic Review of Anatomy, Biomechanics, and Clinical Outcomes

Connor P. Littlefield, B.A., John W. Bell, B.A., Darby A. Husak, B.A., Matthew J. Kraeutler, M.D., Robert F. LaPrade, M.D., Ph.D., Jorge Chahla, M.D., Ph.D., and Eric C. McCarthy, M.D.

Arthroscopy 2021

- Five articles analyzed the biomechanics of the ALL (Pearl et al 2018, Park et al RESTA 2019, Weber et al AJSM 2019, Delavoy et al Arthroscopy 2020, Kennedy et al Tech Orthop 2018)

Conclusion: "The ALL acts as a secondary stabilizer to the anterior cruciate ligament and helps resist internal knee rotation and anterior tibial translation"

 PennState Health
 Penn State Orthopaedics

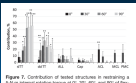

11


Anterolateral Rotatory Biomechanics – It's Not JUST the ALL...

The Role of the Anterolateral Structures and the ACL in Controlling Laxity of the Intact and ACL-Deficient Knee

Changsup Kim, MD, PhD, Scott R. Genua, PhD, Kevin K. Adams, PhD, Chanyu W. Suen, PhD, FRCS, Andrew Steiner, MD, PhD, Jack Allread, FRCS, and Andrew A. Amis, FRCS, Orthopaedic Biomechanics Research Group, University of Liverpool, UK

- IT band is the key structure, more than the ALL
- Superficial and Deep (Kaplan's Fibers) and Capsuloosseous Layers of IT band resist IR & Ant. translation
- Both Intact and ACL deficient state

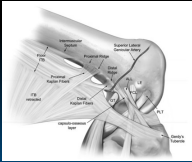



 PennState Health
 Penn State Orthopaedics
Kiittl, Amis AJSM 2015

12

Lateral side of the knee critical to controlling biomechanics

- Anterolateral Complex (ALC) instead of ALL
- ALC includes:
 - Iliotibial band with its superficial, deep, and capsulo-osseous layer
 - Anterolateral joint capsule
- May or may not have a specific capsular "ligament"
- Biomechanical studies - The ALC is a 2nd stabilizer to the ACL and helps resist internal knee rotation and possibly anterior tibial translation




PennState Health Penn State Orthopaedics

13

Can we improve ALC reconstruction to help technique and...

...Is it worth the risk???





PennState Health Penn State Orthopaedics

14

Haven't we done this before???

1980's Extra-articular tenodesis...

- Non-anatomic procedures
- Concerns about over-constraining knee → Arthritis
- Often required long periods of casting → Stiffness
- Outcomes fairly poor across techniques
 - Fell out of favor
 - Evolution toward the modern intra-articular ACL reconstruction techniques




Dodds JBJS(b) 2014

PennState Health Penn State Orthopaedics

15


Are Lateral Augmentation Procedures Bringing Us "Back to the Future"???



PennState Health Penn State Orthopaedics

16


Maybe we can keep the baby, but throw out the bathwater....



PennState Health Penn State Orthopaedics

17

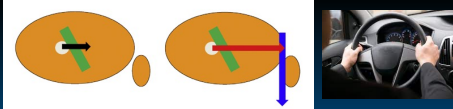
Less Constrained, and in CONJUNCTION with ACLR



PennState Health Penn State Orthopaedics

18

• Lateral extra-articular tenodesis (LET) vs ACLR
– Moment arm of LET >> ACLR

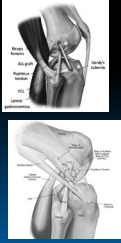


PennState Health Penn State Orthopaedics
Williams Arthroscopy 2018

19

2 Major Lateral Augmentation Procedures

- ALL Reconstruction
 - Allograft or autograft
 - Tunnel on tibia 1/2 way Fib- Gerdy
 - Graft superficial to LCL
- Lateral extra-articular tenodesis (LET)
 - ITB left attached at Gerdy's
 - Using different fixation on femur
 - Variability in tunnel positions on femur
 - Graft deep to LCL and slings around

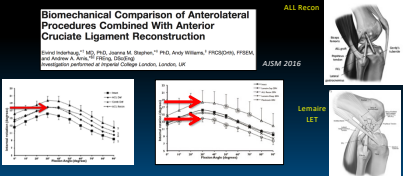


PennState Health Penn State Orthopaedics
Geeslin AJSM 2017

20

What is the best method to control rotation?

Biomechanical Comparison of Anterolateral Procedures Combined With Anterior Cruciate Ligament Reconstruction



PennState Health Penn State Orthopaedics
AJSM 2016


21

Stability Study

- RCT ACLR vs ACLR + LET
- 624 patients randomized / 523 at 2 years f/u
- Age 18.9
- 2+ or greater pivot
- High Beighton score (hyperlaxity)
- ACLR with HS
- 41% graft failure in ACLR (vs 25% ACL + LET)
- PROs same

Conclusion: The addition of LET to a single-bundle hamstring tendon autograft ACLR in young patients at high risk of failure results in a statistically significant, clinically relevant reduction in graft rupture and persistent rotational laxity at 2 years after surgery.

Getgood et al AISM 2020

 PennState Health Penn State Orthopaedics

25


Stability II Study – Currently in process


- International Multicenter Trial
 - Quadriceps and Patellar Tendon
 - With and without LET
- Evaluate failure rates, return to play, Patient reported outcomes

 PennState Health Penn State Orthopaedics

26

So Where Are We?



 PennState Health Penn State Orthopaedics

27


When to add LET to ACLR?

- Level 5 considerations for use of "ALC recon" (Musahl KSSTA 2017)
 - Revision ACL, especially if do not have a clear reason for failure of primary procedure
 - With primary ACLR in high-grade pivot shift or ligamentous laxity
- Open procedure, extra lateral knee incision
- Low (But NOT no...) morbidity
- Does not change rehab

PennState Health Penn State Orthopaedics

28

Modified Lemaire Lateral Extraarticular Tenodesis



PennState Health Penn State Orthopaedics

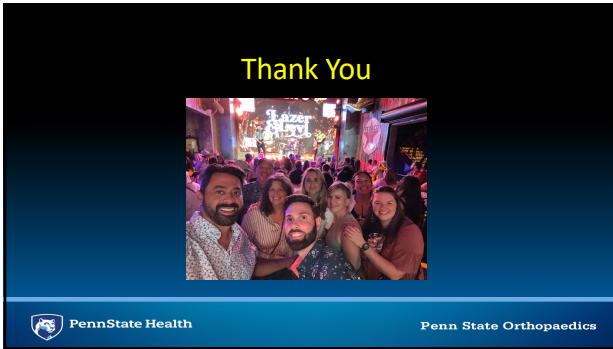
29

Summary

- Lateral Extraarticular Tenodesis (LET) is a tool to help control rotatory biomechanics of the knee
- Indications are evolving
- Retain the benefits of rotatory control, while obviating the historical overconstraint issues
- Revisions and ligamentously lax individuals
- Athletes less than 21 yrs of age (Controversial)???
- Low Morbidity, does not change rehab

PennState Health Penn State Orthopaedics

30



31