

Presented by:  
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0:00 Introduction

0:44 30 Years After Appreciating Non-contact ACL higher rates in basketball,  
what progress have we made?

1:36 30 Years of Observation has led to many research ideas

- 80 males, 64 females
- Knee injuries: Number (% of gender)
- Males, 11 (13%); Females 34 (53%)  $p<.0001$
- 20 (18%) underwent surgery
- Males 6 (7.5%); Females 20 (31%) – 21 surgeries  $p=.0007$
- ACL reconstructions: 2 males, 8 females

2:48 Sex Based Considerations  
in caring for common sports injuries  
ACL Injuries and Management

- Epidemiology highest Female:Male rate differences<sup>1</sup>
- Basketball and Team Handball

3:15 ACL Injury Rates NCAA 1989–2004  
Basketball  
Women:Men 3.38

Soccer  
Women:Men 2.75

3:59 Sex Differences Incidence 2–8 Times Greater Rates of ACL Tears

- Basketball
- Team Handball
- Netball
- Alpine Skiing
- Soccer

4:13 Risk Factors Resulting in ACL Injuries

- NOT modifiable:
- Anatomic/Structural
- Hormonal
- Modifiable:
- Neuromuscular/biomechanical
- Expert think tanks agree that modifiable factors are most important

- Emphasize modifiable factors for return-to-play and prevention programs

#### 4:57 Anatomic Differences in the Knee

##### No Sex Differences

- Notch size and shape
- Tibial slope on sagittal measurements
- Normal: 10° posterior slope
- Greater Posterior Slope is a risk factor for ACL injury
- Size of ligament
- Femoral condyle size and shape

#### 5:35 Notch Size and Shape

- No Sex Differences
- Smaller Notch and Ratios = Greater ACL Tear Rate

#### 6:37 Notch View Radiographs

##### Patient Numbers

- 108 ACL Injuries  
55 women, 53 men
- 186 Intact ACL  
94 women, 92 men
- Width Femur + Notch
- Ratios Femur/Notch
- Shape A vs. Non-A

#### 6:58 BONY MORPHOLOGY

##### Shape and Size of Femoral Condyles

##### Female Knee

Less wide and significant difference medial more than lateral femoral condyle

#### 8:09 Tibial Plateau Geometry

- No Sex Differences
- Tibial Plateau Risk Model:
- Medial and Lateral Slope
- Medial Tibial Depth

Odds Ratios	1mm And	MTP	Female	Male
4.18				3.58
	1°			
		Posterior Slope		

#### 9:03 Central Sagittal Slice

#### 9:29 Intrinsic

- Hormonal / Joint Laxity
- Data are insufficient to make any conclusive statement regarding menstrual cycle of knee laxity and on the rate of ACL injury in females

10:38 The COL5A1 Gene Is Associated With Increased Risk of ACL Tears in Females

- Gene that encodes alpha1 chain: of
- Type 1 collagen ACL tears
- Type 5 collagen Achilles tendon injuries

11:32 Hypermobility (excessive joint laxity) associated with increased incidence of musculoskeletal injury

11:53 Extrinsic

- Kinematics
- Valgus Collapse and increased knee abduction moment
- 205 female athletes, 9 ACL tears
- Greater abduction moment predicted ACL injury p less than .

001

12:29 female vs male Physical

14:26 Mechanisms of Injury

- No Sex Difference in noncontact Mechanisms
- Weight bearing Pivot Shift

15:14 Basketball ACL Tear Video

15:47 VROOM . . .

- Valgus
- Rotation
- Out
- Of control
- Movement

16:28 How do we teach athletes to land in a safe position?

18:45 Core Stability

Never too early to start?

18:59 Prevention and post ACLR rehab programs:

No Sex Differences

19:44 ACL Reconstructions

American Board of Orthopaedic Surgeons

- Most common age ACL reconstructions in US:
- 15 years for females
- 18 years for males

Kentucky Sports Medicine Sex Differences ACLR

- Females are younger than males by 5 years

20:55 MLI Experience, 1990-2005

- Rates of Revision/Retear
  - Females: 5.1% | Males: 4.0%
- Basketball ACL Subsequent Surgeries
- Reconstructed side 3%
  - Opposite side 6%
  - Total ACL Surgeries: 1909 on 1305 PTS.
  - 745 (39%) Female | 1164 (61%) Male
  - Multiple ACL Surgeries: 209 on 84 PTS.
  - 38 (45%) Female | 46 (55%) Male

21:57 Return to Play/Activity Level  
Moon Study

- 100 Soccer Athletes (55) Male (45) Female
- Average age 24.2 years
- 7 year follow up 30% still playing
- Females more likely to have further ACL Surgery
- 20% vs 5.5%,  $p=0.03$
- Older athletes and females less likely to RTP  $p=0.37$

22:47 Outcomes

Graft Failure/Future Surgeries

- Meta Analysis 13 studies – no sex differences in:
- Graft Failure Risk (8)
- Contralateral ACL Rupture Risk (3)
- Laxity Post OP Clinical Exam (6)
- No difference evidence of a clinically important in patient recorded outcomes according to sex
- More high quality studies are needed...

23:25 Development of Osteoarthritis

Swedish ACL Registry

- 84 female soccer players ACL injuries
- 12 year follow up.
- 42% Symptomatic Knee OA
- 75% Symptoms affected QOL
- No difference if underwent ACLR compared to those who had not

24:25 Development of Osteoarthritis

Longer term Registry follow up needed

25:17 Is Decision Making Different for ACL Management Based on SEX?  
NO

- Treatment by Health Care Professionals
- Decision to Reconstruct ACL and Graft Choice
- Desire to Compete and Win

25:47 “The Uneven Playing Field”

- By Michael Sokolov  
New York Times, May 11, 2008
- Janelle Pierson

- High school soccer player
- Multiple ACL injuries, both knees
- Mindset: after surgeries, multiple knee injuries
- Rehab hard
- Get back on the field
- Compete fiercely
- Hope not to be injured

27:05 I Can Take the Pain Video

28:00 Sex Based Considerations in Caring for Common Sports Injuries

28:53 ACL Injuries and Management

29:05 Thank you...

---END OF PART 1---

0:00 Introduction

1:15 Surgical Management

- Graft Choice
- No Sex Difference
- Do not change based on cosmetic concerns
- Pearls
- Smaller Shorter Patient
- Adjust Femoral Fixation
- Use Suspension or Bioabsorbable Devices
- Avoid Iatrogenic ITB Syndrome

2:35 Special Considerations in Females

- Shorter femoral condyle
- Adjust fixation accordingly
- Absorbable/HA interference screw or endobutton

2:51 16 YO Female Soccer Athlete

- Autograft B-PT-B graft
- Height 5' 2", weight 106 lbs.

3:42 16 YO Female Soccer Athlete

- Xrays: 2 weeks after hardware removal

5:00 Arthroscopy femoral screw removal 9 months after ACLR

6:36 Failed ACLR Left Knee 18 months prior Hamstring Autograft

- 17 yo Female Basketball Division I prospect
- Not My Primary Case!
- Played a Year in a Brace
- Why Failed?
- Tunnel Placement

- When Failed?
- Ever stable?
- Unknown

8:49 Arthroscopic Findings Video

10:56 36Y0 Female  
Professional basketball athlete  
Allograft ACL reconstruction

11:33 2 Years Post ACL recon

12:04 3.5 years Post OP with increasing knee pain.

12:14 Knee “pack-years” as in smoking:  
Additive effects of years of participation in basketball. . .

- Pack-years of smoking on lungs
- Pack-years of activity on knees

? Too many pack years of basketball ?

13:25 Brian Noehren PT, Ph.D., FACSM  
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13:58 10 Months R ACLR Video

15:17 10 Months Right ACLR Full Sports

16:10 7 Months Right ACLR Full Soccer Video  
•Forward Trunk & Pelvic Tilt ,Trendelenberg

17:13 7 Months Post OP Playing Soccer  
Abnormal Gait and Knee ROM

17:35 7 Months Right ACLR Playing Soccer

17:50 Gait Analysis, Balance, and Strength  
What do we compare?  
Normal vs Post ACLR vs Uninjured Leg

19:21 Go further upstream look at the trunk.

- Running post ACLR
- Hip angles can be normal
- Greater ipsilateral trunk lean

19:45 Trunk Control R ACLR  
Trunk Control Test Errors:  
 $p = 0.001$   
ACL = 7.1 Control = 3.4 ACL Opposite = 5.8

21:02 YES FEMALES ARE DIFFERENT!

Confidence Code Sports  
Reflections

21:19 THE CONFIDENCE CODE... Video  
Katy Kay BBC & Coauthor The Confidence Code

23:02 Sport and Athlete Video

23:38 Difference between men and women