

Presented by:
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612 RTP Safe or Sorry PT1

0:00 Introduction

0:26 Disclaimer

0:33 Objectives

- Understand the tests in functional assessment done prior to RTP after ACLR
- Communicate with rehab team to develop RTP protocols
- Evidence based functional assessment tests should be developed
- Ask Questions!

1:22 What are we afraid of?

- Retear
- Athlete not performing well
- Surgeon looks bad
- Injure something else
- Develop OA
- Going to Get It Anyway
- Angry athlete parent coach

2:52 Orthopaedic Surgeons Can Stabilize the Knee, but not restore it to pre injury state.

Timing of Return to Play?

Rethink Biologic Healing

Variable due to Multiple Factors...

3:20 Development of Osteoarthritis (Lohmander LS, Ostenberg A, Englund M, Roos H. High prevalence of knee osteoarthritis, pain, and functional limitations in female soccer players twelve years after anterior cruciate ligament injury. Arthritis Rheum 2004;50:3145-3152) 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

4:55 Significant Findings:

- Non op more likely develop meniscus tear OA and undergo TKA

compared to early ACLR

- Delayed more likely develop meniscus tear and OA compared to early ACLR

5:53 Purpose: Evaluate protective benefit of ACLR and evaluate factors predictive of long term sequelae

Mean FU 13.7 Years

Range 2 month – 25 years

964 Patients new onset ACL tears vs. sex match cohort without ACL tears

- 364 Non Op
- 509 Early ACLR
- 91 Delayed

Level of evidence 3

6:36 Results

Age greater than 21 years Time of Injury articular cartilage damage medial lateral meniscal tears predicted OA after ACLR

6:59 Conclusions

- Patients undergoing ACLR significant lower risk of meniscus tear symptomatic OA and TKA compared to non OP
- Early ACLR significantly reduces risk of subsequent meniscus tear and OA compared to delayed ACLR

7:22 36Y0 Female

Professional basketball athlete

Allograft ACL reconstruction

8:14 3.5 years Post OP with increasing knee pain.

9:06 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 ?

9:40 Goal ACL return to play after ACLR

- KNOW YOUR RETURN TO PLAY TEAM.
- Understand the tests that assess strength and movement patterns after ACLR
- Show you the tests performed in functional assessments to determine readiness to RTP.
- Understand what these tests are measuring.
- Review mechanisms of injury and how this relates to safe return to play and prevention programs
- Questions and Discussion

10:17 Short term: safer not faster return to play

Long term: prevention of osteoarthritis

- Average return to play 6 months
- Varies with each individual patient age and sport
- Many factors the athlete must overcome prior to return:
- Fear of reinjury
- Reestablishing strength balance hip and knee control

11:31 Appropriate Use Criteria Adopted by AAOS October 2015

11:54 ACL Reconstruction Surgery Checklist

13:28 Quality and Variability of Physical Therapy Protocols for ACL Reconstruction

IN THE US THERE ARE NO STANDARDIZED OR EVIDENCE BASED PROTOCOLS

- 155 Academic Orthopaedic Programs
- 33 Online post ACLR Protocols
- Substantial variability in types of exercises time to RTP
- Protocols not supported evidence based practices
- By Standardizing protocols might lead to improved outcomes

14:45 Functional Assessment Tests

- Basic vs. Advanced
- Strength – leg press
- Balance
- Timed agilities
- Sport-specific dry-land testing to show athlete level of readiness to return to field of competition

15:46 What are the tests done to determine readiness for return to play?

Functional Assessment Level 1

- Gait assessment
- Single leg step and hold x10
- Y Balance
- Strength testing
- Knee extension isometric 90°
- Hip abduction and seated external rotation
- One leg at bridges to fatigue
- Plank

16:12 Grading scale

- 3 = normal
- 2 = minimal deviation
- 1 = moderate deviation
- 0 = marked deviation
- Assessment
- Passes all phases did not pass all phases because of the following deficiencies
- Pain
- Decreased eccentric knee control neuromuscular strength proximal strength

16:39 Functional Assessment Level 2: Return to play

- Hop testing in inches
- Vertical hop
- Single-leg brought jump
- Timed 6 m hop
- Single-leg triple jump
- Single-leg crossover jump
- Hop testing quality assessment
- Good trunk control sufficient knee flexion avoid valgus

17:26 Level to clearance for sports

•Drop-off box to squat jump plyometric repeat 3-5 times graded on 0-3

- Feet symmetrical and hit together
- Symmetric insufficient knee flexion
- Landing is soft
- Avoid valgus
- Landing is balanced

18:05 Functional Assessment Level 1

18:38 Functional Assessment Level 2

19:15 Advanced Functional Assessment

20:56 Thank you

612 RTP Safe or Sorry PT2

0:00 Introduction

0:26 Disclaimer

0:34 Functional Assessment Test

- Basic vs. Advanced
- Strength – leg press
- Balance
- Timed agilities
- Sport-specific dry-land testing to show athlete level of readiness to return to field of competition

1:36 What are the tests done to determine readiness for return to play?

Functional Assessment Level 1

- Gait assessment
- Single leg step and hold x10
- Y Balance
- Strength testing
- Knee extension isometric 90°

- Hip abduction and seated external rotation
- One leg at bridges to fatigue
- Plank

2:01 Grading scale

- 3 = normal
- 2 = minimal deviation
- 1 = moderate deviation
- 0 = marked deviation
- Assessment
- Passes all phases did not pass all phases because of the following deficiencies
 - Pain
 - Decreased eccentric knee control neuromuscular strength proximal strength

2:30 Functional Assessment Level 2: Return to play

- Hop testing in inches
- Vertical hop
- Single-leg brought jump
- Timed 6 m hop
- Single-leg triple jump
- Single-leg crossover jump
- Hop testing quality assessment
- Good trunk control sufficient knee flexion avoid valgus

3:15 Level to clearance for sports

- Drop-off box to squat jump plyometric repeat 3-5 times graded on 0-3
 - Feet symmetrical and hit together
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 - Landing is soft
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3:55 Functional Assessment Level 1

4:28 Functional Assessment Level 2

5:05 Advanced Functional Assessment

6:48 Functional Assessment Videos

8:55 Best test(s) to do to predict RTP Safely?

9:36 Donald Shelbourne MD Video

12:15 How to best get Quadriceps Back ...

- Eccentric
- Open Chain

- Safe variations of Eccentric Quad
- Total Gym with bands early
- Later Higher Weights

13:49 Eccentric Quad – Safe Or Sorry?

14:56 Use of ALTER G when to start post ACLR

15:19 Fear of Reinjury? Kinesiophobia Scales

16:03 Simple Single-Leg Squat

Give clinicians information on neuromuscular control

Plank Test

- Measures lumbar and pelvic control in side or sagittal plane
- Can see excessive lumbar lordosis

Observe in Fatigue and Non-fatigue states

16:34 What I Have Observed

- Mechanism of Injury
- High risk vs. low risk landing position

18:44 Alignment Proximal control / Core stability

19:33 What we test:

Trunk control: through side plank, plank test

Knee control: Repeated step downs– assess frontal and Sagittal plane control

Knee strength: Isometric quadriceps strength test

Through these functional tests we aim to better quantify, qualitative assessments of neuromuscular control that we feel may predispose someone to a subsequent injury.

20:04 Brian Noehren PT, Ph.D., FACSM b.noehren@uky.edu

20:41 Single Leg Mini Squat

21:48 How Many Step Downs in 60 sec?

ACLR Side 31.8

p=.008

“Normal Side” 36

p=.026

Normal Control 40

Noehren B. et al work in progress

22:34 10 Months R ACLR Video

23:27 10 Months Right ACLR Full Sports

24:23 7 Months Right ACLR Full Soccer Video

26:20 7 Months Post OP Playing Soccer
Abnormal Gait and Knee ROM

26:43 7 Months Right ACLR Playing Soccer

26:56 Gait Analysis, Balance, and Strength

What do we compare?

Normal vs Post ACLR vs Uninjured Leg

What are the objective measurements of?

Hip, Trunk, Balance, Gait

What do the functional tests we do really tell us?

Tell the Patient if they are ready or not.

What are the Best Tests to Do?

28:31 Trunk Control R ACLR Video

Trunk Control Test Errors:

$p = 0.001$

ACL = 7.1 Control = 3.4 ACL Opposite = 5.8

29:32 Intervention Approach

•Emphasize hip abduction and
external rotation

•Proper body position

•Back, hip and knees

•Integration of core musculature
to functional activities

30:30 Functional Tests: Triple Jump Video

31:21 Functional Tests: TRX Video

32:08 Functional Tests: Y Balance Video

33:05 Functional Tests: Vertical Jump Video

33:39 Single Leg Balance Catch Video

34:34 Thank you

612 RTP Safe or Sorry PT3 –Sex and Sports: Caring for the Female
Athlete ACL Injuries

0:00 Introduction

0:26 Disclaimer

0:21 Sex Based Considerations in Caring for Common Sports Injuries

1:25 30 Years After Appreciating Non-contact ACL higher rates in
basketball, what progress have we made?

2:43 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 less than.0001
- 20 (18%) underwent surgery
- Males 6 (7.5%); Females 20 (31%) – 21 surgeries p=.0007
- ACL reconstructions: 2 males, 8 females

M. L. Ireland, C. Wall, "Epidemiology and Comparison of Knee Injuries in Elite Male and Female United States Basketball Athletes" MSSE 1989. Presented at ACSM Annual Meeting Salt Lake City, Utah

4:07 Sex Based Considerations in caring for common sports injuries
ACL Injuries and Management

- Epidemiology highest Female:Male rate differences1
- Basketball and Team Handball

4:33 ACL Injury Rates NCAA 1989–2004

Basketball Women:Men 3.38

Soccer Women:Men 2.75

5:50 Sex Differences Incidence 2–8 Times Greater Rates of ACL Tears

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

6:14 Increased Risk of Second ACL Injury
for Female Soccer Players

- 180 Female ACLR Retrospective Study
- 90 Soccer Athletes
- 90 Non-Soccer Athletes
- 5.8 year follow-up
- ACL Graft tears and contralateral tears significantly greater in soccer athletes

•Return to Soccer and Older Age were significant factors for ACL rerupture but not contralateral tear.

Soccer Female Athletes More Likely to Tear Contralateral Side than Their Reconstructed Side

Our ACLR is better than the Normal. LET THEM PLAY EARLIER!

8:06 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

8:57 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

9:44 Notch Size and Shape

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

10:54 Notch View Radiographs

- 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

11:18 BONY MORPHOLOGY

Shape and Size of Femoral Condyles

Female Knee:

Less wide and significant difference medial more than lateral femoral condyle

11:44 Tibial Plateau Geometry

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

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

12:27 Central Sagittal Slice

12:51 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

13:35 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

14:07 Hypermobility (excessive joint laxity) associated with increased incidence of musculoskeletal injury

14:24 Extrinsic

- Kinematics
- Valgus Collapse and increased knee abduction moment
- 205 female athletes, 9 ACL tears
- Greater abduction moment predicted ACL injury $p < .001$

16:23 Mechanisms of Injury

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

17:05 Basketball ACL Tear Video

17:37 VROOM . . .

- Valgus
- Rotation
- Out
- Of control
- Movement

18:06 Knee: Cone of Stability

18:34 How do we teach athletes to land in a safe position?

20:06 Prevention and post ACLR rehab programs:
No Sex Differences

20:44 What the Prevention Programs have in common?

- Emphasize safe landing positions
- Neuromuscular recruitment
- Should be sport-specific
- Program must be done properly and participation documented
- Look at all lower extremity injury rates, not just ACL tears

21:21 Lower Extremity Injury Prehab Program

Message: Performance enhancement, not injury prevention

21:52 Landing is EVERYTHING!

22:04 Difference in gender sports video

22:35 Difference between men and women

22:49 Who is driving the ACLR RTP Train?

23:45 Thank you