John R. Sutton Clinical Lecture 9th Annual

Entitled to Compete: Destined to Tear Her ACL – What we know, What we don't know, and Where do we go?

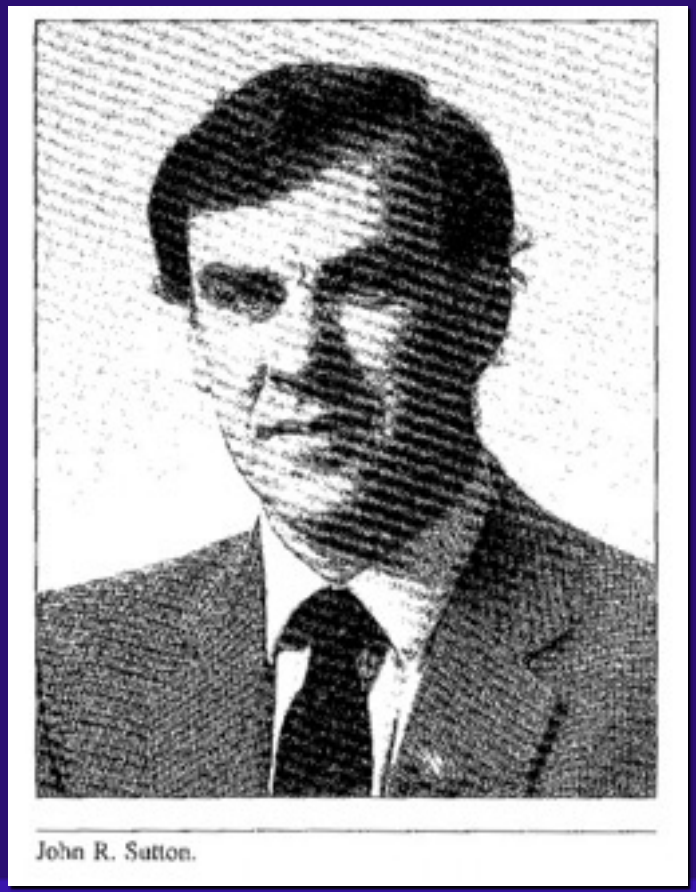
Mary Lloyd Ireland, M.D.
University of Kentucky
Dept. of Orthopaedic Surgery
& Sports Medicine

Entitled to Compete: Destined to Tear Her ACL – What we know, What we don't know, and Where do we go?

MAIN MENU

Many, One” by Heyward L. Nash, “Exploring the Medical Aspects of Sports: One Man’s Goal,” PS, May, 1986, 213-215,219

John R. Sutton
March 31, 1941-
February 7,1996

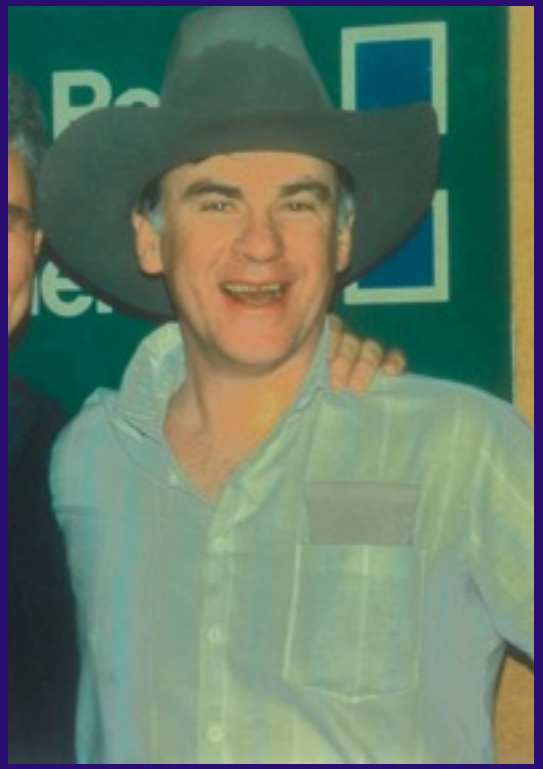


John R. Sutton.

John R. Sutton

- Physician and Professor of Medicine at McMaster University
  Hamilton, Ontario, Canada

- 30th ACSM President



John R. Sutton

- Major Research Interest: Exercise and High altitude pathophysiology - cardiorespiratory, metabolic, endocrine function
- Editorial Board Member on international Journal of Sports Medicine, Journal of Applied Physiology
- His Aim: “to integrate the basic sciences with the clinical aspects of exercise and altitude physiology.”

John R. Sutton

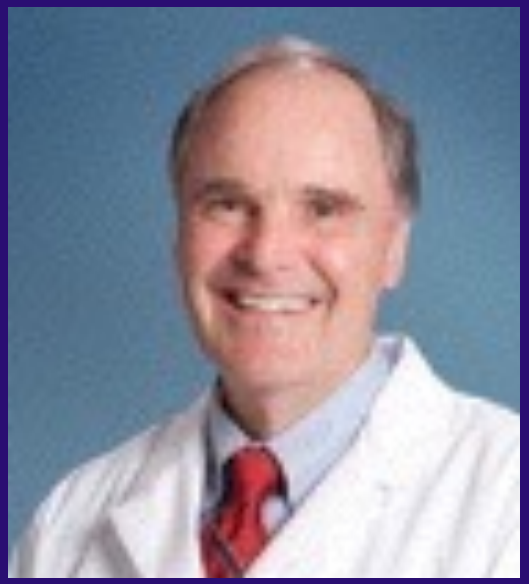
Believed in 1986 ACSM:

- “. . . could become one of the most important public education forums in the country for all things related to physical activity…”
- “should be a reservoir of knowledge in all areas of exercise science and sports medicine.”
-

John R. Sutton

- Stressed that his "entire philosophy stems from an interest in and enthusiasm for education"
- Remarked that "scientists like myself have a responsibility to come out of the ivory tower and help educate at the grass roots level"
- I wish I had known him— We are grass roots researchers who ask clinical questions and take it back to the lab…No Ivory Towers!

Ben Levine Stan Herring Ben Kibler



Karim Khan

Bill Roberts

Roald Bahr

Fran O'Connor Lyle Micheli

Ireland, ML, "Research: It Takes Bricks and Mortar," *Sports Medicine Bulletin,* Vol. 33, No 3., 1998

- ACSM Campaign: "Building for the Next Millenium"
  - Mortar is a piece of ordnance, large-bore, for firing heavy objects at low velocity from great angles of elevation
- ACSM Members
  - Are the mortar
  - We share, we communicate, we learn from each other
- Research Drives Us

WHIAB (Women's Health Issues Advisory Board)

- John Healey, MD
  - Council on Research and Quality
  - Noted that sexes in animal research was not documented
  - Passed a mandate that there is a box to be checked for sex for research projects for ORS

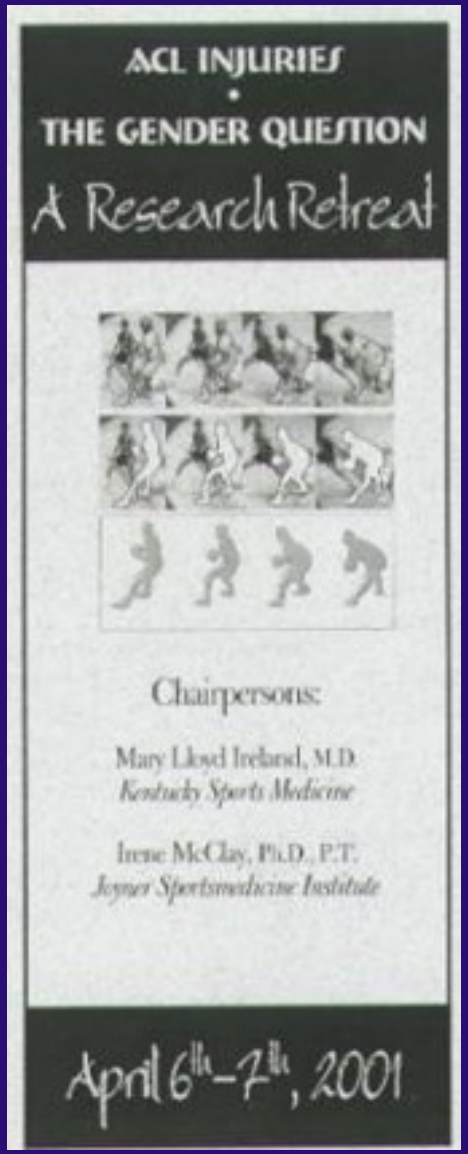
Great added mandate in research to compare differences in males and females

Women's Health Issues Advisory Board: I'm Proud to be a New Member!

ACL Research Retreat: The Gender Question / Bias

Lexington, Kentucky

- Research Retreat I: April 6-7, 2001
  - Davis IM, Ireland, ML. ACL research retreat: the gender bias, April 6-7, 2001. *Clinical Biomechanics* 2001;16(10):937-959.
- Research Retreat II: April 4-5, 2003
  - McClay-Davis I, Ireland ML. Research Retreat II – ACL injuries—The gender bias. *Journal of Orthopaedic & Sports Physical Therapy* 2003;33(8):A-1-A30.
- Research Retreat III: April 6-8, 2006
  - Davis IM, Ireland ML. ACL Injuries: The Gender Bias: Research Retreat III – April 6-8, 2006, Lexington, Kentucky. *Journal of Orthopaedic & Sports Physical Therapy* 2007;37(2): A1-A32.



ACL Research Retreat III
April 6-8, 2006
Lexington, KY

QUESTIONS:

What do we know?

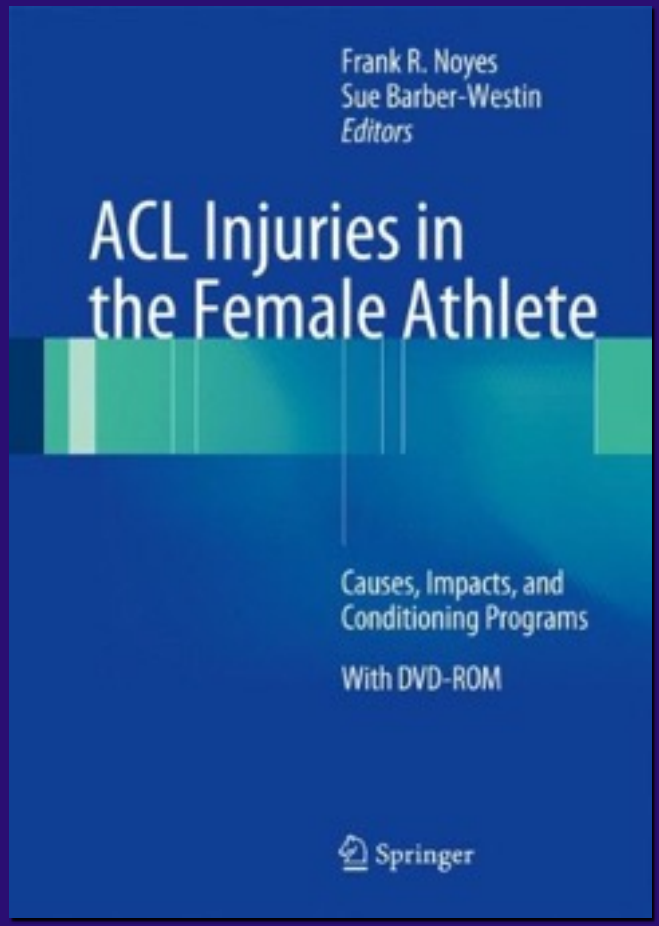
What don't we know?

Where do we go from here?

Abstracts and consensus statements in *JOSPT* 2007;37(2): A1-A32.

"The ACL Research Retreat was cofounded by Irene Davis, PhD, P.T and Mary Lloyd Ireland, M.D. in 2001 to present and discuss the most recent research on ACL injury risk … and to identify new research directives…"

Sandra J. Schultz and Randy J. Schmitz Chapter 22, What We Know and Goals for Future Research

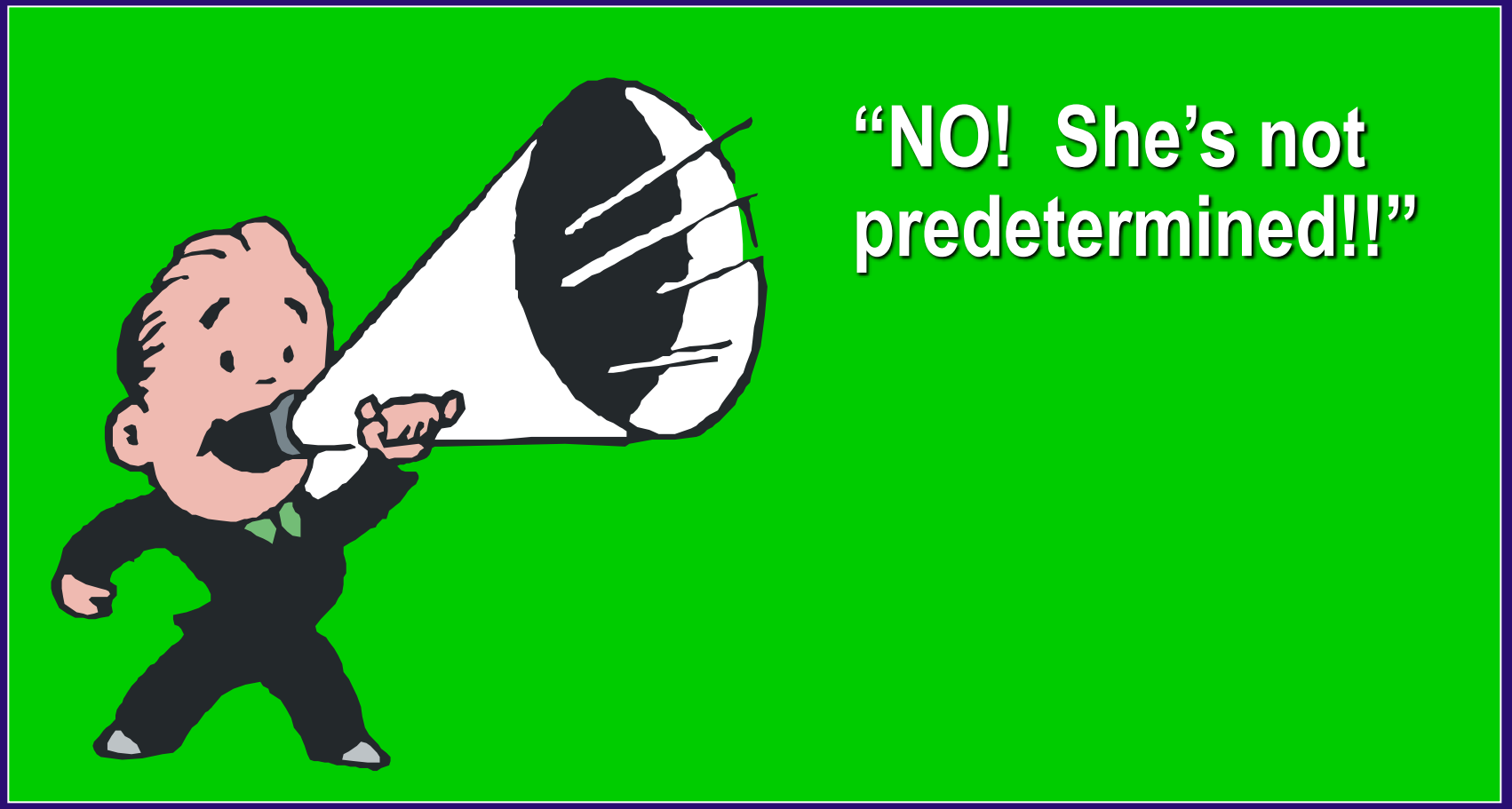


Invited Commentary

Ireland ML, "The Female Athlete: Entitled to Compete, Predetermined to Tear Her Anterior Cruciate Ligament?," Current Sports Medicine Reports 2005, 4(2), March 2005, 57-60.

NO!

Female Athlete entitled to compete predetermined to tear her ACL?




NEWSLETTER OF THE AMERICAN ORTHOPAEDIC SOCIETY FOR SPORTS MEDICINE
Sports Medicine
UPDATE
JANUARY/FEBRUARY 2013
New Disclosure Process
OJSM to Launch in Early 2013
Annual Meeting Housing Open
40 YEARS OF TITLE IX
AOSSM
www.sportsmed.org

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

25 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

  - 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

What we Know:
She is at higher risk compared to males in sports…

Collegiate Level: Basketball 3.5 X
Soccer 2.8 X

NCAA ISS (Injury Surveillance System)

What We Don't Know?

High school and younger

We need more epidemiology studies to compare ages and types of sports

What we Know:
She is at higher risk compared to males in sports…

Elite Level: Team Handball 5X

Grethe Myklebust, PT, PhD
Oslo Sports Trauma Research Center
Norwegian Olympic Center

Military US Naval Academy

- **Intercollegiate** **3.96**
  (Soccer, Basketball, Rugby)
- **Intramural** **1.40**
  (Soccer, Basketball, Softball, Volleyball)
- **Military Training** **9.74**

Gwinn DE, Wilckens JH, McDevitt ER, Ross G, Kao TC, "The relative incidence of anterior cruciate ligament injury in men and women at the United States Naval Academy." *Am J Sports Med* 2000. Jan.-Feb.; 28(1):98--102.

What we know:

- Females are competitive
- Females are athletes
- Females tear their ACL more often than Males in comparable sports
  - Basketball
  - Soccer
  - Team Handball
- Females who compete in sports are more successful in their careers

Are there sex differences?

Yes!

- Triad
- Musculoskeletal Injuries
  - ACL Tears
  - Patellofemoral disorders
  - Stress Fractures
- Professional opportunities
- Aggressiveness and contact nature of sport

"Now get out there, Jennifer, and KILL!"

"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

Katy Kay, BBC & Coauthor The Confidence Code

- 

Multiple 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

Ireland ML, Durbin T, Bolgla Lori. **Gender Differences in Core Strength and Lower Extremity Function During Single Leg Squat.** In: ACL Injuries in the Female Athlete: Causes, Impacts, and Conditioning Programs, Noyes FR, Barber-Westin SD Eds, Springer-Verlag, Berlin Heidelburg, 2012.

Good Morning America

Bony Anatomy: What We Know

- Small notch, smaller ACL
- Not sex-dependent

(Ireland ML, et. al., A Radiographic Analysis of the relationship between the size and shape of the intercondylar notch and ACL injury). Knee Surgery, Sports Traumatology, Arthroscopy 2001;9:200-205.

- Increased slope, lateral tibial plateau greater risk in females, not males

Beynnon BD, et. al., Increased Slope of the Lateral Tibial Plateau Subchondral Bone Is Associated With Greater Risk of Noncontact ACL Injury in Females but Not in Males: A Prospective Cohort Study with a Nested, Matched Case Control Analyis, *AJSM*, 42:5 (May 2014), 1039-1048.

National Cruciate Ligament Registry in Norway

www.haukeland.no/nrl/

- Established June 12, 2004
- Overview: *Matt Hasson,* "Scandinavian ACL registries could serve as models for large European database, "*ORTHOPAEDICS TODAY INTERNATIONAL* 2006; 9:25
  www.orthosupersite.com/view.asp?rID=18593

- Study presented at ISAKOS Congress in Florence, May 2007
- Authors: Granan LP, Engebretsen L, Bahr R,
  Oslo Sports Trauma Research Center,
  Ullevaal University Hospital, Oslo, Norway

Sports Multicenter Outcomes Studies
MOON ACLR, MARS & MeTeOR NIH Funded

1. Original MOON ACLR (Spindler)- 2002-2005

2. MOON SHOULDER (Kuhn) The largest (and only) prospective longitudinal outcome cohort to identify features that predict success with non-operative treatment of full-thickness rotator cuff tears. Design and sites based on original MOON platform.

3. MARS MARS with AOSSM (Wright) Collaborative multicenter cohort (offered to all AOSSM members) to identify causes and modifiable risk factors for worse outcomes in Revision ACLR. Design based on original platform, but grew to include 83 surgeons (the number needed to accrue enough revision surgeries), *with nearly half the sites in private practice.*

4. MeTeOR MeTeOR (Katz) Randomized controlled trial to establish efficacy of surgery compared with nonoperative therapy in patients with symptomatic meniscal tear and osteoarthritis. Six of seven study sites were MOON or MARS participants.

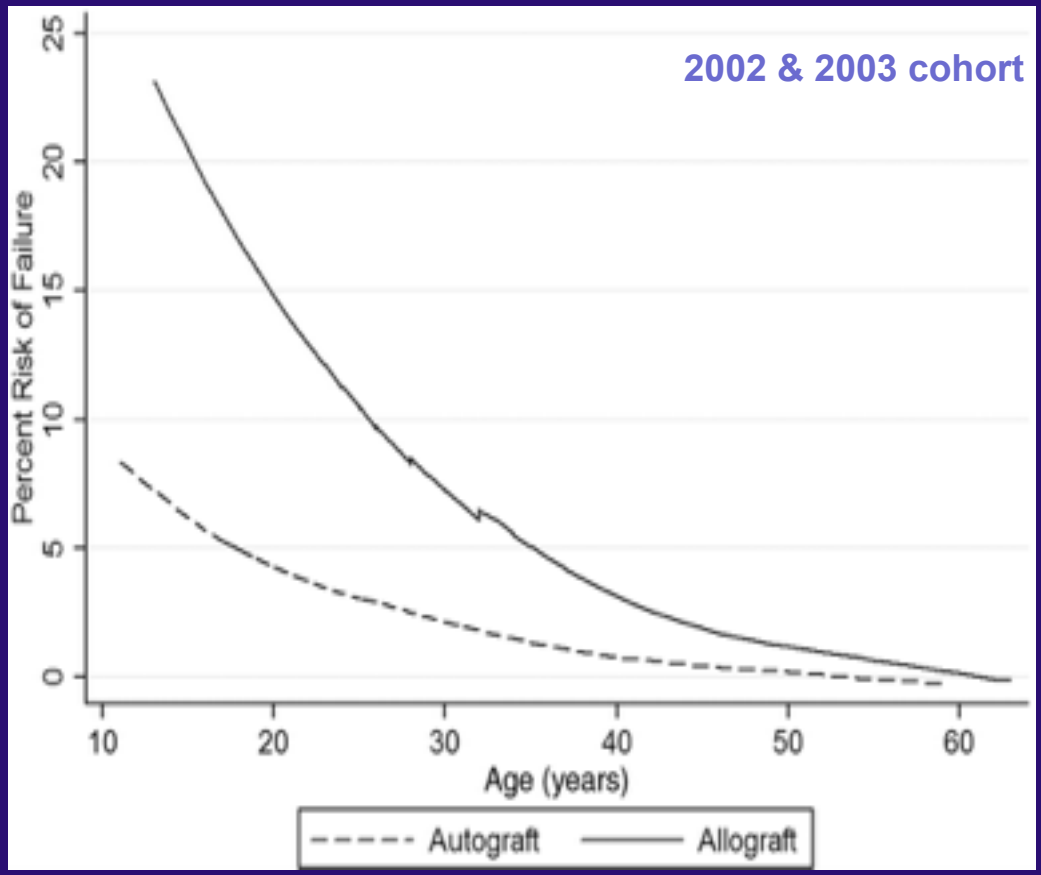
Is Allograft vs. Autograft a Cause of Primary ACLR Failure?

Kaeding et al., AOSSM 2008, Sports Health 2011

- >2 yr follow-up by phone or questionnaire, n ≈1000
- 94% follow-up; failure defined as revision
- Results

Allo vs. Auto
18 yr: 20% vs. 6%
40 yr: 3% vs. 1%

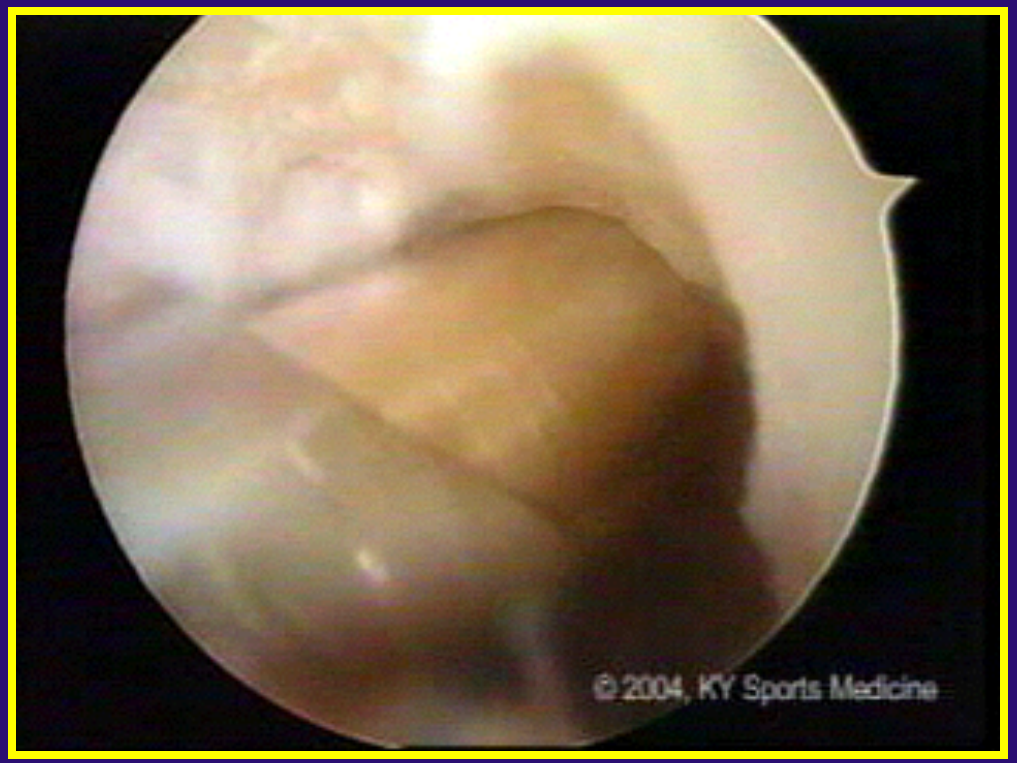
NNH (# needed to harm) is 7 for high school age patients



Conclusion 2-Year Outcomes & Predictors

Question	Answer	Predictors	Don't know
Does **Bone Bruise cause pain** at ACLR?	**No**	BMI & female	Longer term bone bruise outcomes
What is the predicted **Activity Level 2 yrs post-ACLR**?	**Decrease by 4** from t0	Revision, Age, Female	Clinically meaningful change
What is the likelihood of **Contralateral ACL Tear**?	**3%**	Unknown (requires greater sample size)	Predictors
What is the likelihood of **ACLR Graft Failure**?	**1-20%**	Allograft, younger age, higher activity	Types of allografts
What is the likelihood of **Meniscus Repair Success**?	**94%**	Unknown	% union of tear
What is the predicted **KOOS at 2 yrs**?	**Improved, Not normal**	Revision, Smoking, G2 LCL	Underpowered for Men and Art cart
What is the likelihood of **return to play for football players?**	**~70%**	Fear of re-injury reported by ~50% hs and college who don't return	Predictors

Orthopaedic Surgeons Can Stabilize the Knee, but not restore it to pre injury state.
Rethink Biologic Healing and Timing of Return to Play…
Variable due to Multiple Factors……



1984: We've come a long way from extraarticular to intraarticular anatomic reconstruction . . .

Should we be looking at the oncoming train and not the tunnel?

“Even if you are on the right track, you will get run over if you just stand there.”

-- Will Rogers

Why do we perform ACL Reconstructions?

- A. To prevent Osteoarthritis
- B. To make money
- C. To Get Athletes Back to Pre Injury Level
- D. To Get Subjects for Research Projects
- E. Because It Is Torn

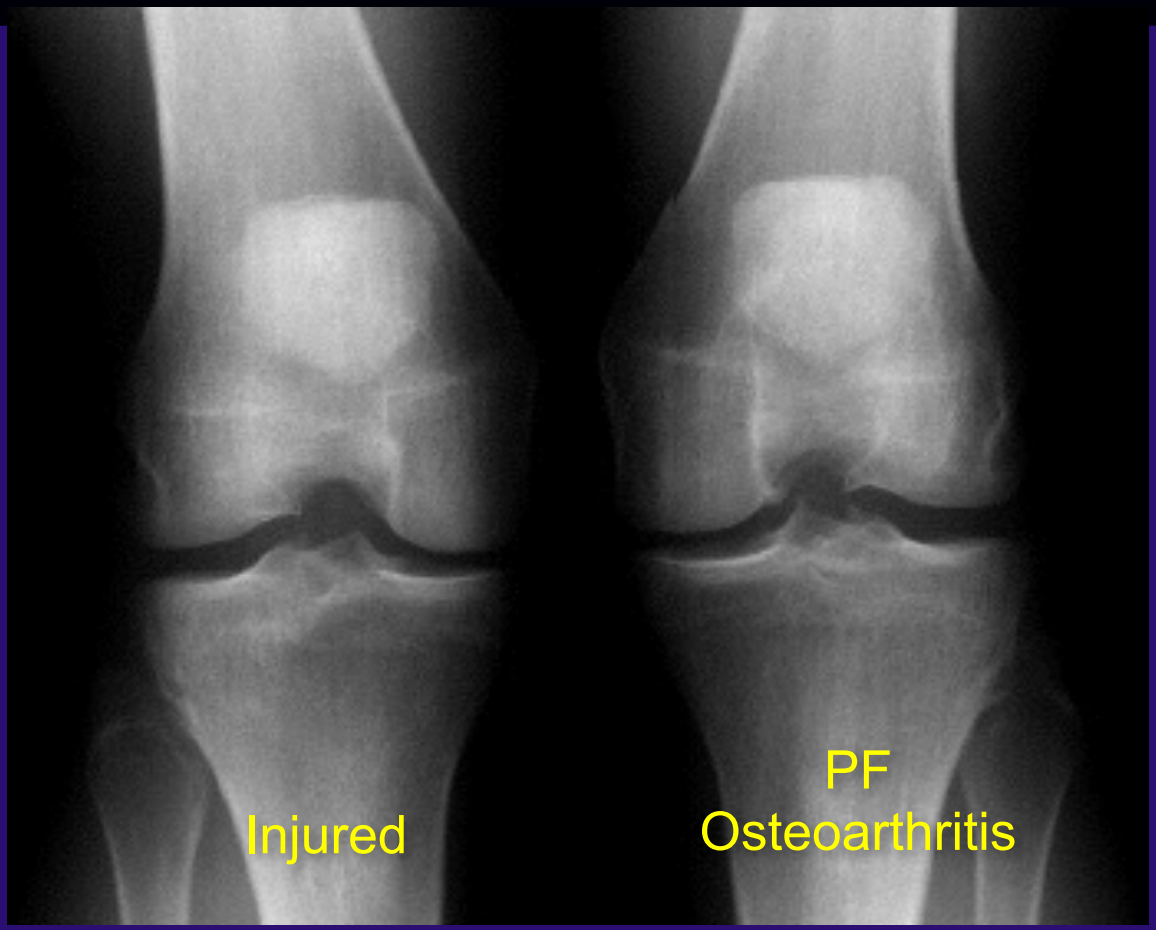
Bottom Line Question with long-term results of ACL reconstruction:

- Can we prevent arthritis?
- Can we restore normal knee function?
- Evidence based results: unknown
- Experience driven: known

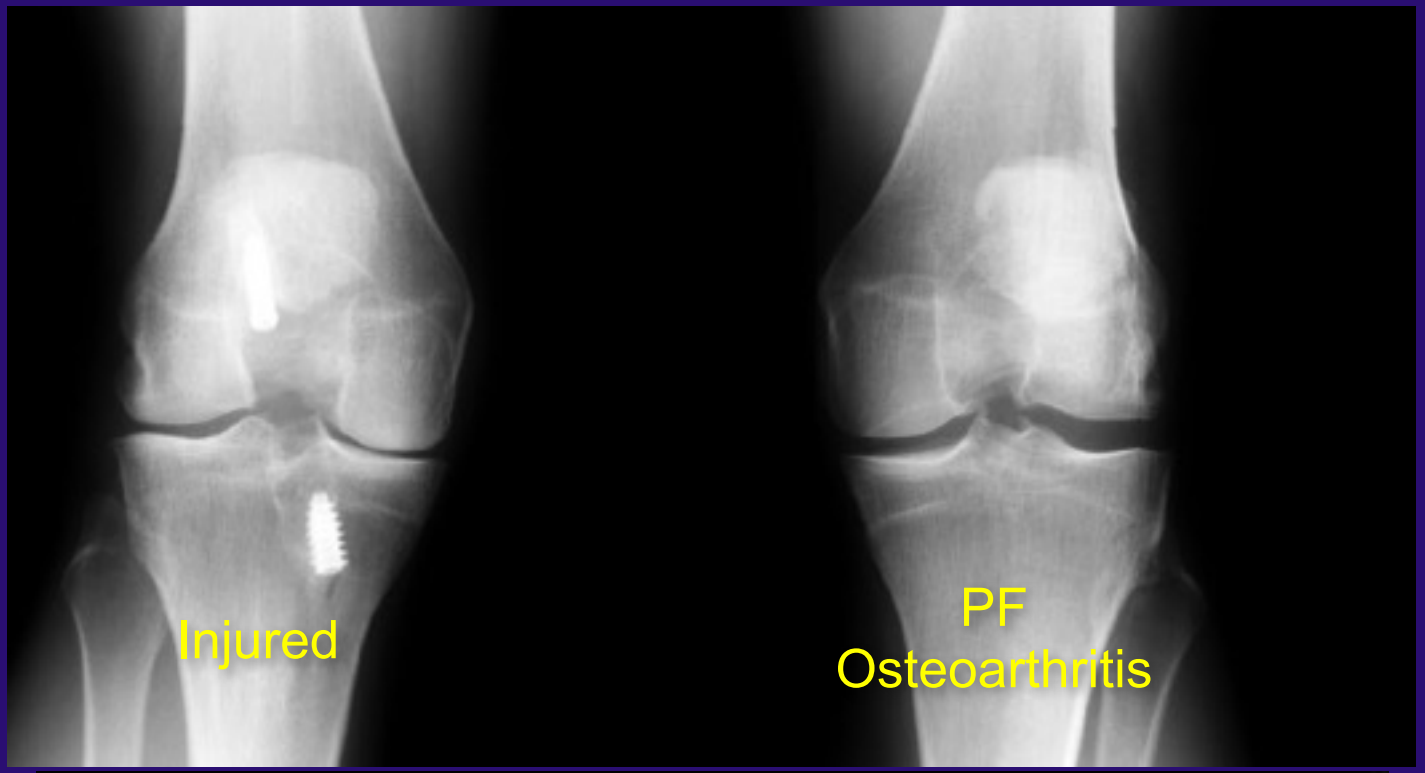
36YO
Female

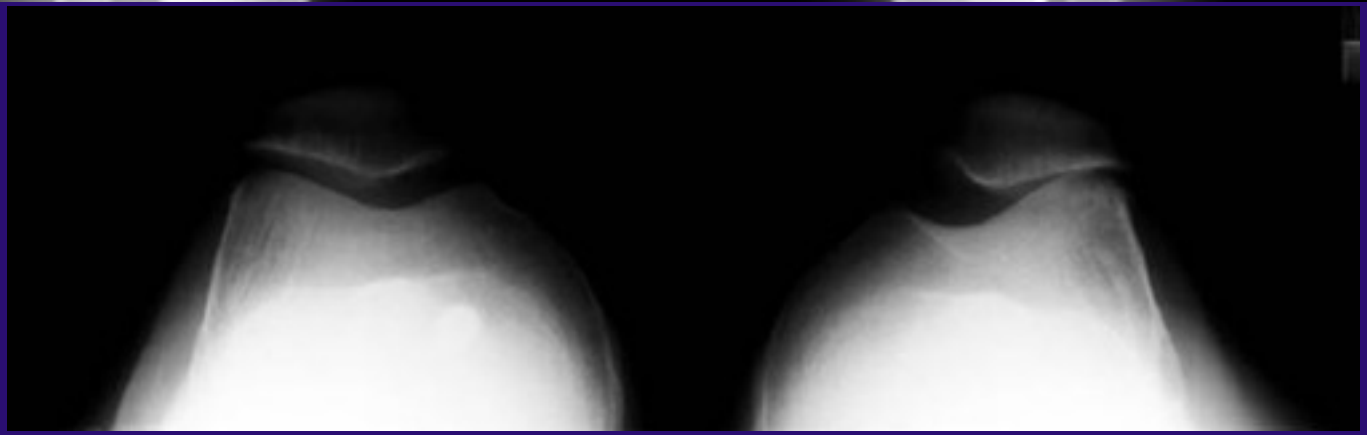
Professional basketball athlete

Allograft ACL reconstruction

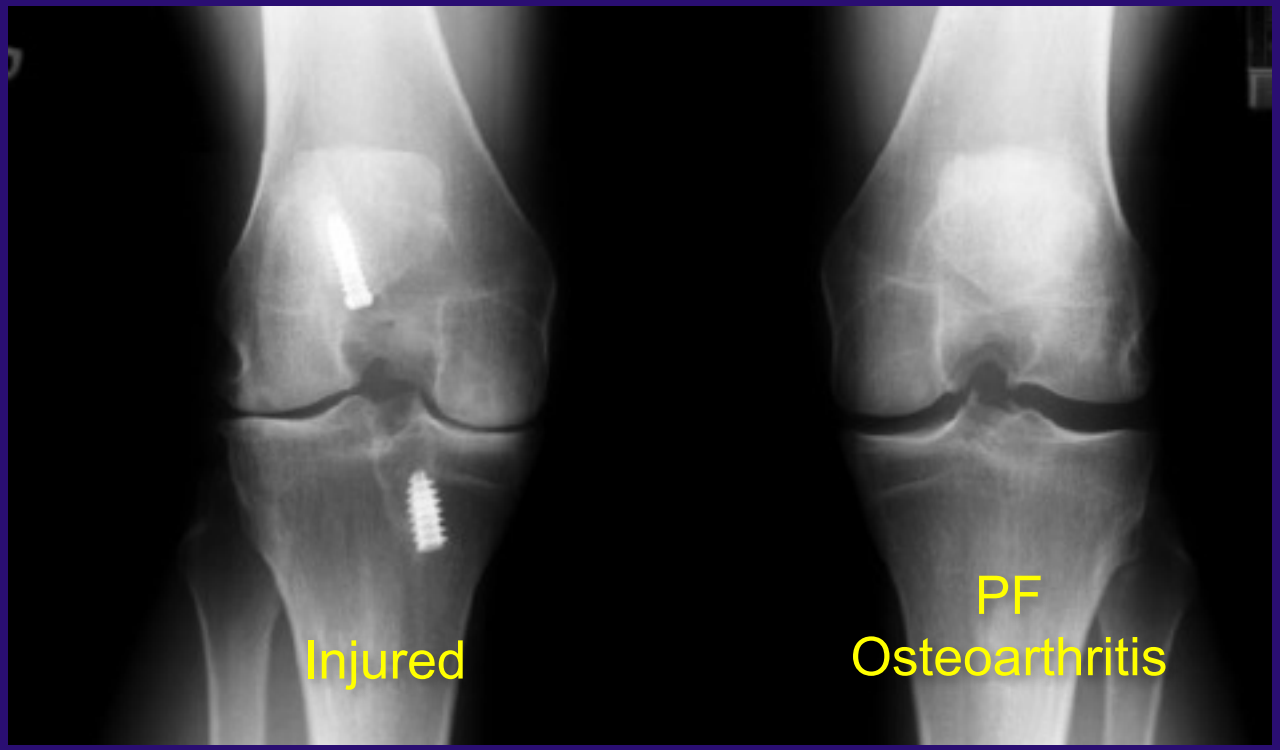


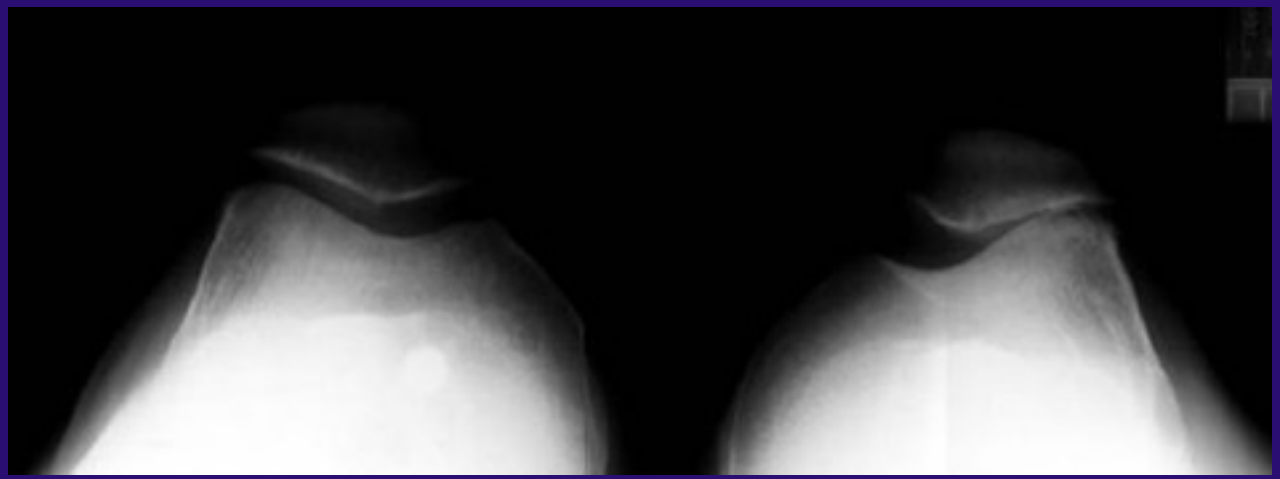
2 Years Post ACL recon

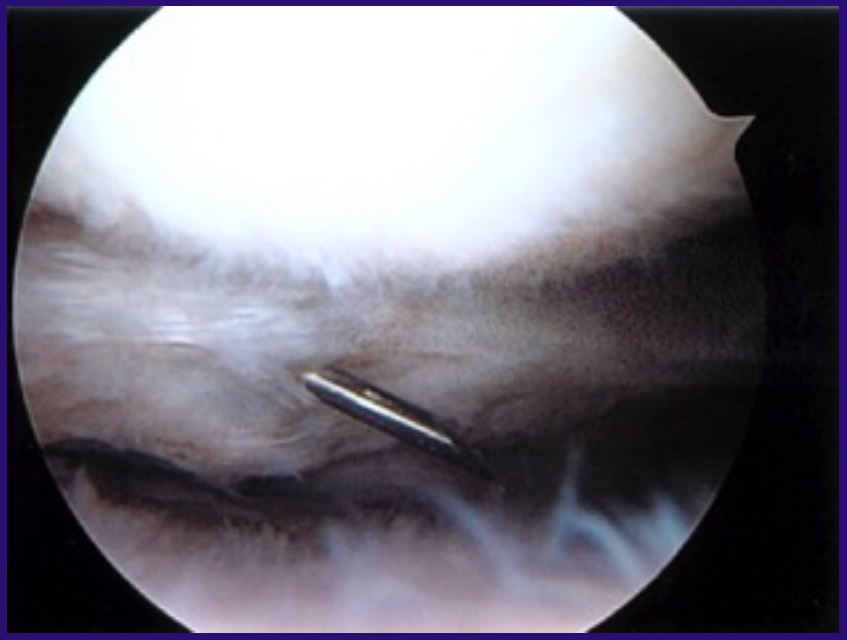


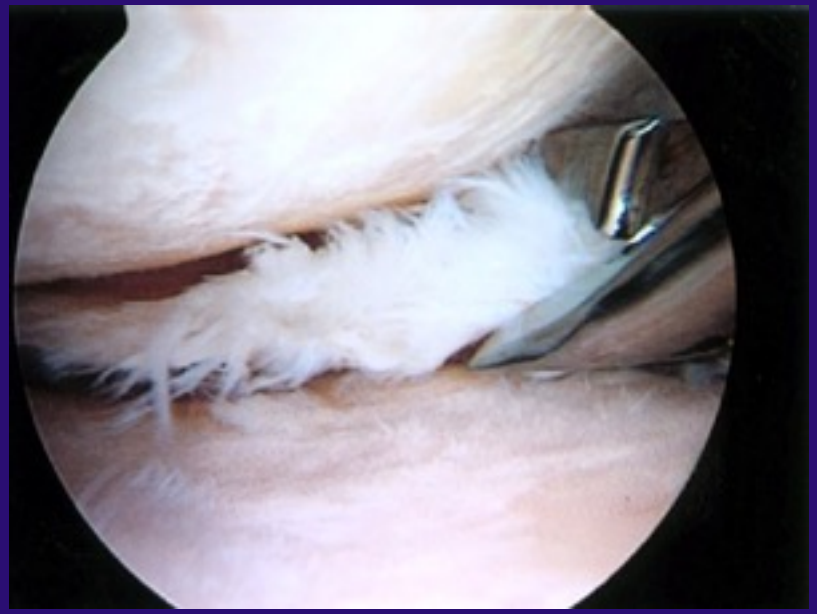


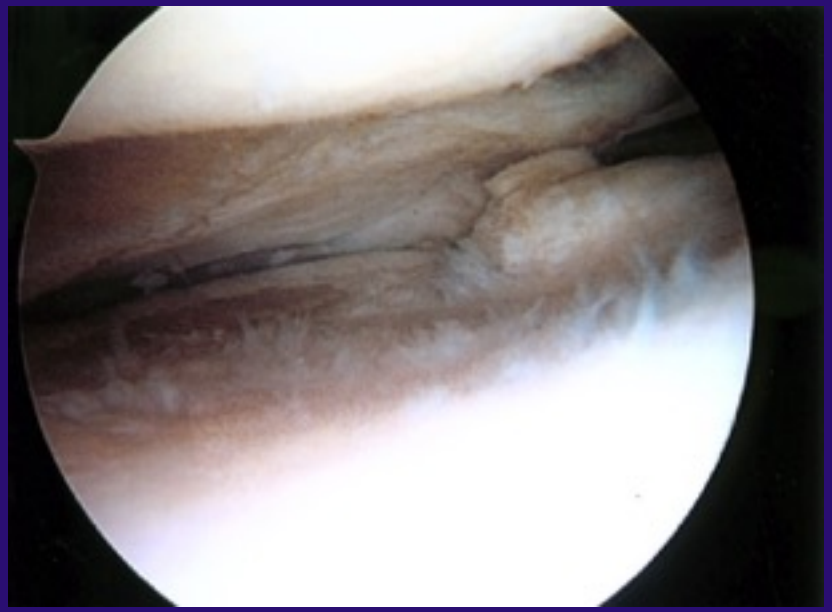
3.5 years postop increasing knee pain







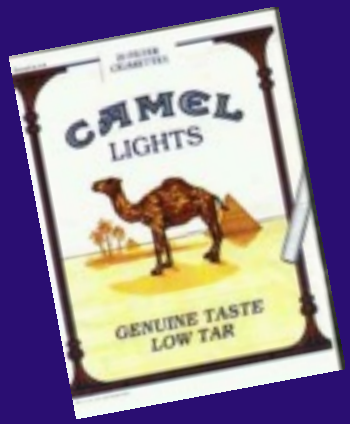




Knee “pack-years” as in smoking: Additive effects of years of participation in basketball. . .

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

? Too many pack years of basketball ?



Tourville TW, et. Al., Relationship Between Isokinetic Strength and Tibiofemoral Joint Space Width Changes after Anterior Cruciate Ligament Reconstruction, AJSM Vol. 42, No. 2, 302-311.

- 39 ACLR and 32 healthy controls
- Prospective Study
- 4 year followup joint space width decrease
  - 30 (79%) and 8 (21%) healthy
  - Quadriceps strength loss soon after injury
  - Significant relationship to joint space width narrowing

Lohmander LS, et. Al., **The Long-term Consequence of Anterior Cruciate Ligament and Meniscus Injuries**, AJSM, Vol. 35, No 10, 1756-1769.

- OA rate: 10 to 20 years after diagnosis, avg. 50%
- Lack of evidence to support that ACL reconstrucion or meniscus repair prevents OA
- Females are at increased risk for OA

These are young patients with old knees.

Ireland, ML. Anterior Cruciate Injury in Female Athletes: Epidemiology, in *J Athletic Training* 1999;34(2), 150-154.

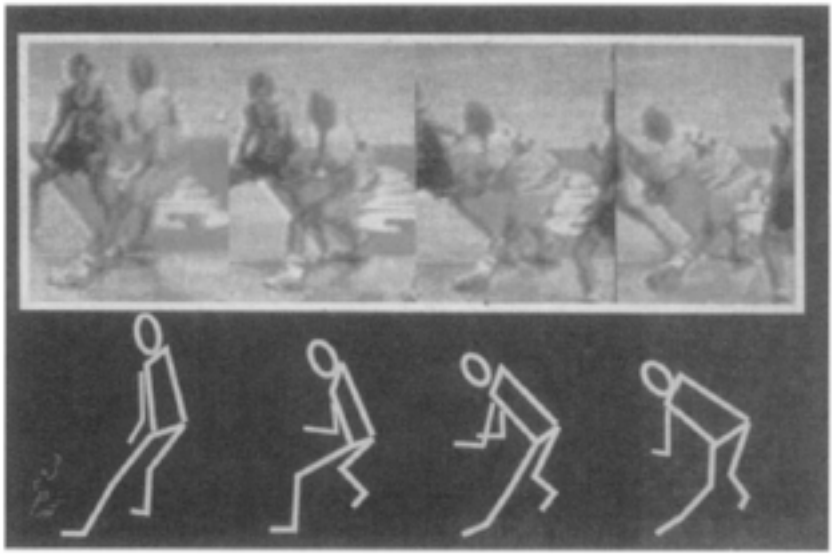
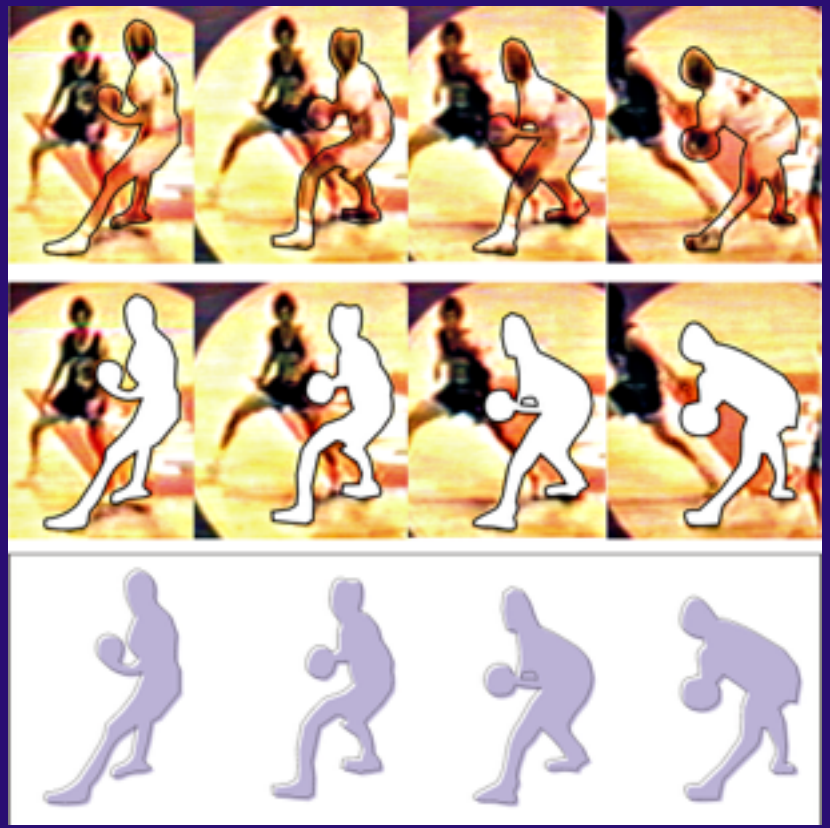
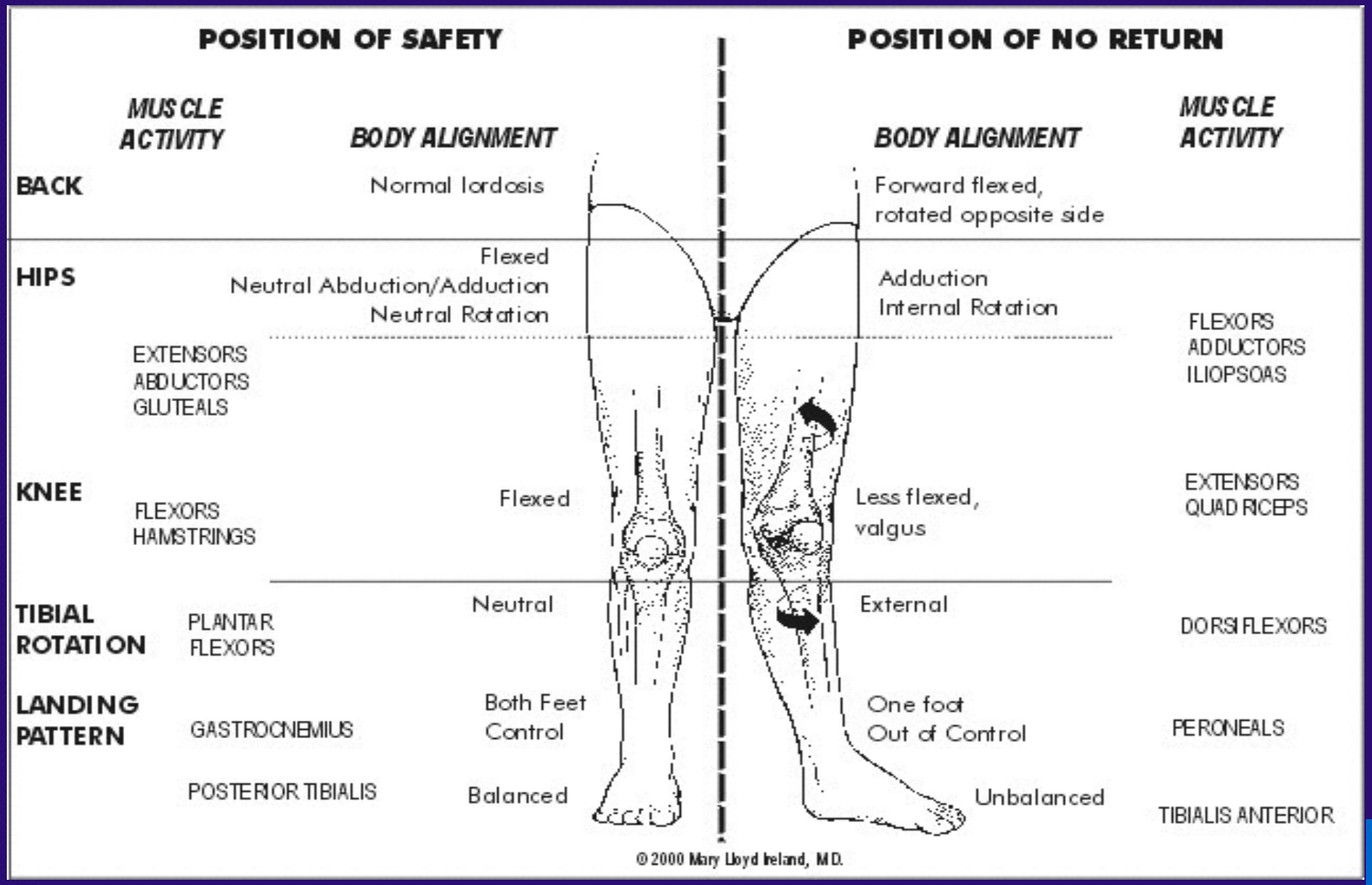


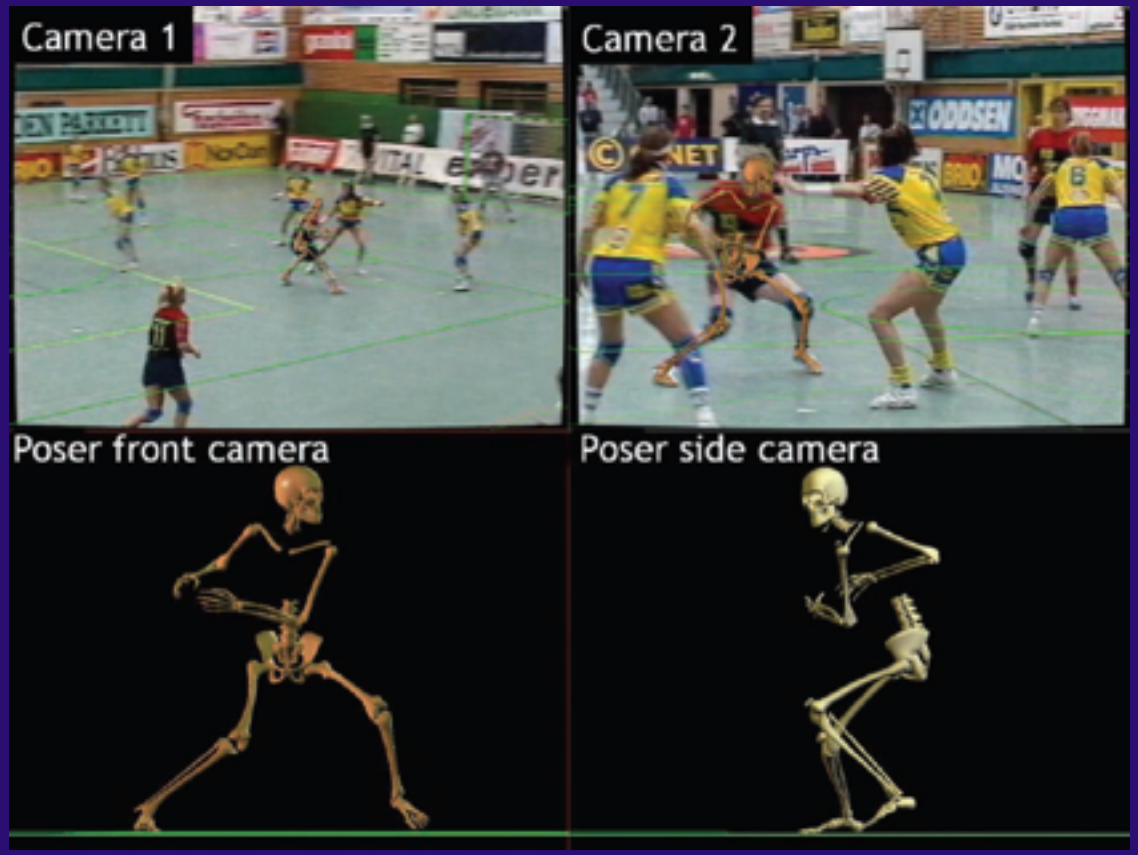
Figure 3. Injury to the left knee as observed from the back and left side of the athlete. She has just rebounded and stops to change direction to avoid the defending player. She lands in an upright position with less knee and hip flexion and forward-flexed lumbar spine. After the ACL fails, she falls forward, and knee valgus rotation and flexion increase. She is unable to upright herself and regain pelvis control to avoid ACL injury.



Injury Mechanisms – Body Positions



40 milliseconds after initial contact



Koga H et. al., Mechanisms for Noncontact Anterior Cruciate Ligament Injuries: Knee Joint Kinematics in 10 Injury Situations From Female Team Handball and Basketball. *Am J Sports Med* 2010;38(11);2218-2225.

Gymnastics

Position of No Return

- Is it really knee valgus?
  - Seen from frontal plane, YES, but NOT from sagittal plane
  - Injury – Landing Pivot Shift
  - Knee: Anterior subluxation of tibia
  - Hip: Internal Rotation and Adduction
- Femoral rotation
  - first internal, then external
- Anterior tibial translation = "valgus collapse"

Get Smart Stay in the Cone of Silence

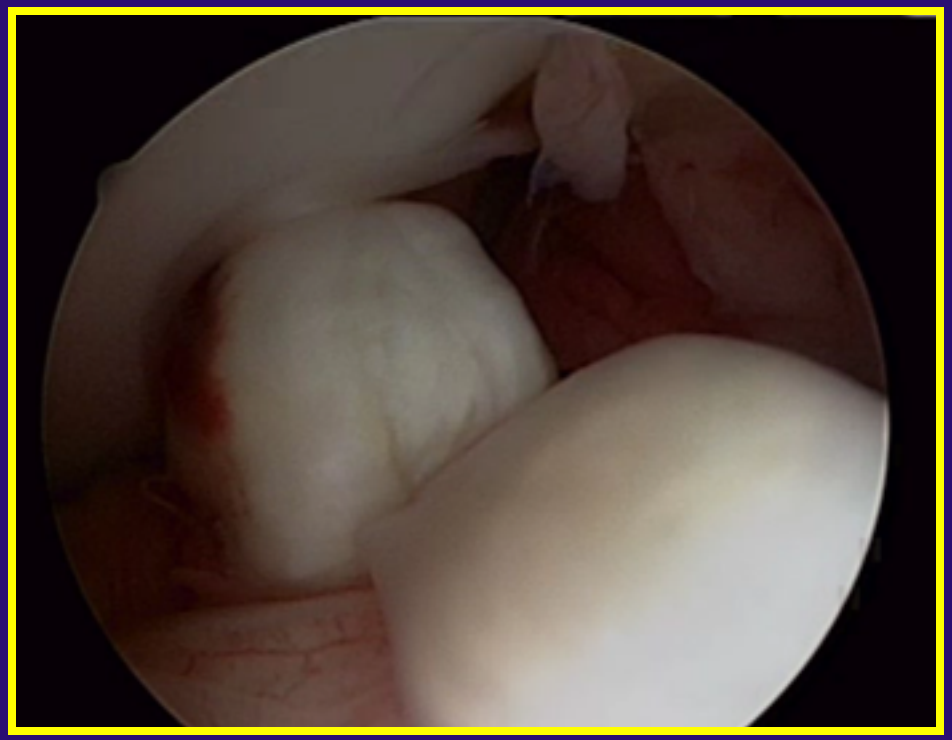
VROOM . . .

- Valgus
- Rotation
- Out
- Of control
- Movement

It takes 70 milliseconds to tear the ACL


LIVE

Tire with a sudden blowout is like . . .



. . . a mop-end tear of ACL

Injury Prevention-ACL Tear

Simple as: ABC's

- **A**gility
- **B**alance
- **C**ore
- **S**trength

What the 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

Intervention Approach

- Recruit core muscles during functional activities
- Command muscles to increase:
  - Abdominal pressure
    - "Draw in" or "hollow"
  - Trunk stiffness
    - "Butt" and "gut" programs

Intervention Approach

- Emphasize hip abduction and external rotation
- Proper body position
  - Back, hip and knees
- Integration of core musculature to functional activities

Prevention Programs

- Published results: do reduce risk of injury
  - Adolescent Females (Tim Hewett, Ohio)
    www.cincinnatichildrens.org/svc/alpha/s/sports-med/acl.htm
  - Soccer (Bert Mandelbaum, Santa Monica, CA)
    www.aclprevent.com
  - Team Handball (Grete Myklebust, Norway)
    www.ostrc.no/en/

Lower Extremity Injury Prevention Program

Sheri McNew, ATC skmcne@uky.edu
Director of Athletic Training Services
University of Kentucky
Dept. of Orthopaedic Surgery & Sports Medicine
Lexington, Kentucky USA
Tel. (859) 218-3131
www.ukhealthcare.uky.edu/sportsmedicine

SPECIAL THANK YOU

- James E. Ireland Foundation
- Post-Time Productions
- Athletic Trainers, Certified: Aaron MacDonald, Amy Waugh, Michelle Meeks, Jantzen Merrimen

Lower Extremity Injury Prehab Program

Message: Performance enhancement, not injury prevention

http://marylloydireland.com/presentations.html

(Prehab ACL)

Swart E, Redler L, Fabricant PD, Mandelbaum BR, Ahmad CS, Wang YC, **Prevention and Screening Programs for Anterior Cruciate Ligament Injuries in Young Athletes: A Cost-Effectiveness Analysis**, *J Bone Joint Surg Am*, 2014 May 07;96(9):705-711.

Implementation of Universal Neuromuscular Training Program:

Save $100 per player per season

Reduce the incidence of ACL injury from 3% to 1.1%

- Screening was not cost effective

Noyes FR, Barber-Westin SD, **Neuromuscular retraining intervention programs: Do they reduce noncontact anterior cruciate ligament injury rates in adolescent female athletes?** *Arthroscopy*, 2014 Feb;30(2):245-55.

Nine Programs Assessed: Four Significantly Reduced Rates

- Sportsmetrics 1999
- Sportsmetrics 1999-2012
- PEP 2005
  - Prevent Injury & Enhance Performance
- KIPP 2011
  - Knee Injury Prevention Program
- Five Did Not:
  - Olson 2005
  - KLIP 2006
  - The “11” 2008 Norway
  - HarmoKnee 2010
  - Walden 2012

The Norwegian ACL handball experience, how to prevent and keep the numbers low?

- Grethe Myklebust, PT, PhD
- Oslo Sports Trauma Research Center
- Norwegian Olympic Center

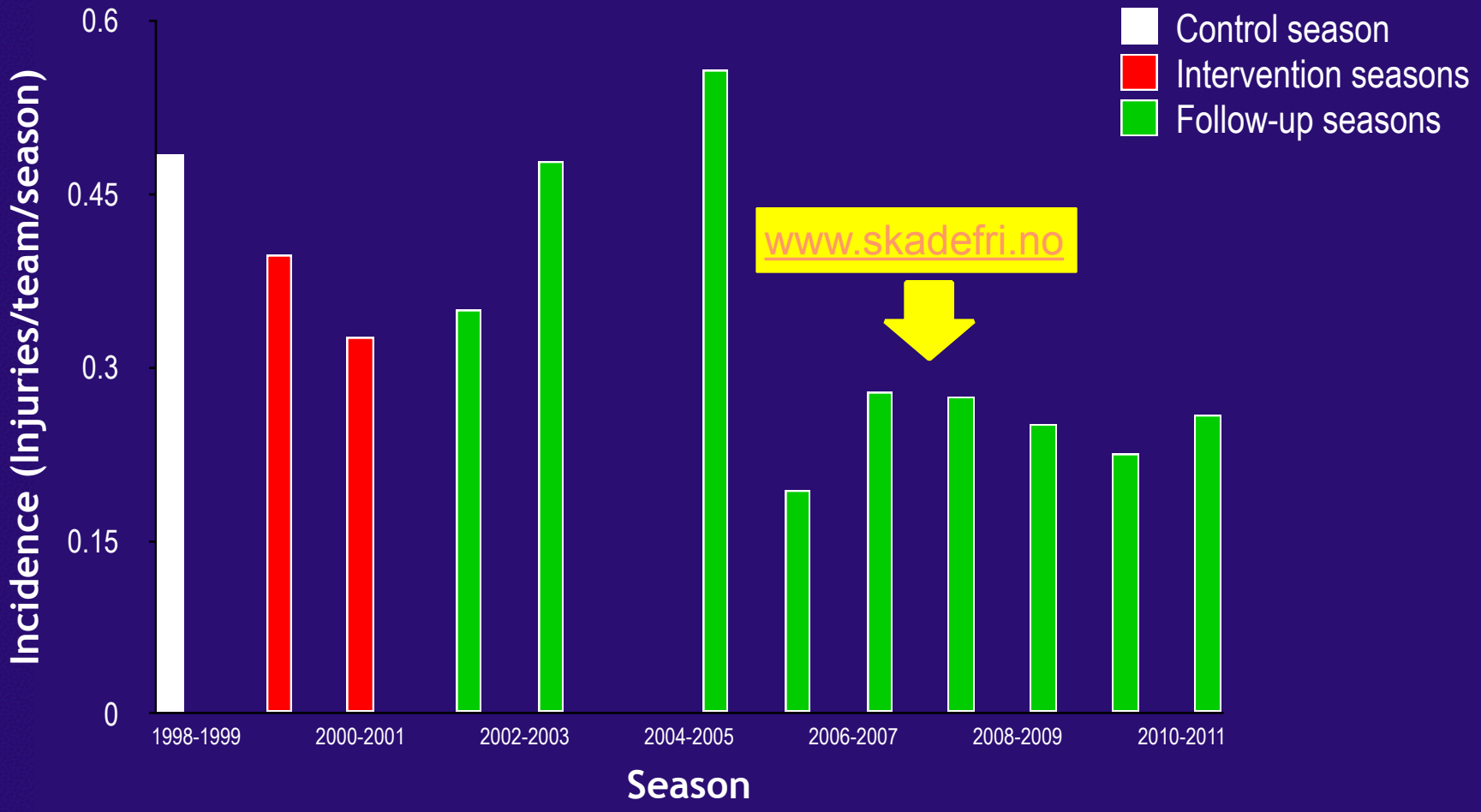
Significant Decrease in ACL Injuries in Women's Team Handball

- 16 Times Greater Risk in Non Trained Group 1998-2001
- 950 Elite Team Handball Female Players
- Control Season then Intervention Seasons

- Three types of exercises with progression:
  1. Floor
  2. Airex balance mat
  3. Wobble board

- «Knee over toe»
- Two-legged landings
- Hip-knee-toe in line
- Balance, strength & plyometrics

Incidence


Control season
Intervention seasons
Follow-up seasons
www.skadefri.no
Incidence (Injuries/team/season)
0.6
0.45
0.3
0.15
0
1998-1999
2000-2001
2002-2003
2004-2005
2006-2007
2008-2009
2010-2011
Season

Why have we succeeded?

- Personal contact with the coaches twice a year
- www.skadefri.no & Skadefri DVD
- Courses in clubs around the country
- Collaboration with the handball federation
- Articles in «Handball magazine»
- Regular focus in media
- Improved coach awareness and knowledge

Observation of ACL Injury Patterns

- Allow us to develop hypotheses in the lab for computer modeling
- Bring lab studies back out to the training room
- Joint position and muscle activation is critical to knee stability
- Strength is not as important as timing of activation
  - Best: hamstrings firing on flexed knee-hip
  - Worst: quadriceps dominance in extended hip-knee

Diagnosing Core Instability

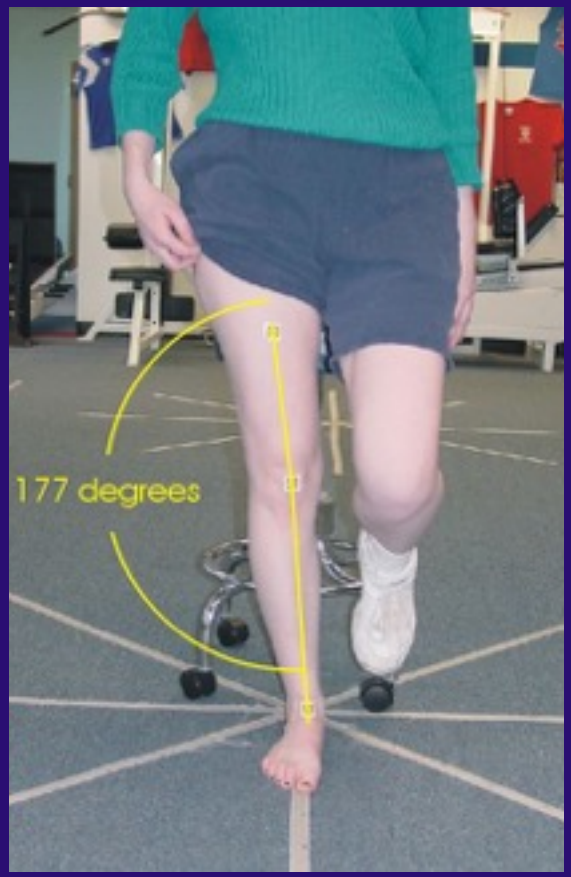
Ireland ML, Willson JD, Ballantyne BT, and Davis IM, **"Hip Strength in Females With and Without Patellofemoral Pain."** In *J Orthop Sports Phys Therapy* 33;2003, 671-676.

Willson JD, Ireland ML, Davis I, **"Core strength and lower extremity alignment during single leg squats,"** *Med Sci Sports Exerc* 2006 May;38(5):945-52.

Leetun DT, Ireland ML, Ballantyne B, McClay IS, **"Core Stability Measures as Risk Factors for Lower Extremity Injury in Athletes."** In *Med Sci Sports Exer* 36(6);2004, 926-934.

Methods: TF Valgus (projection)

Single leg stance



Single leg squat (45°)

- Average projection angle (degrees)

Simple Single-Leg Squat

- Give clinicians information on neuromuscular control

Plank Test

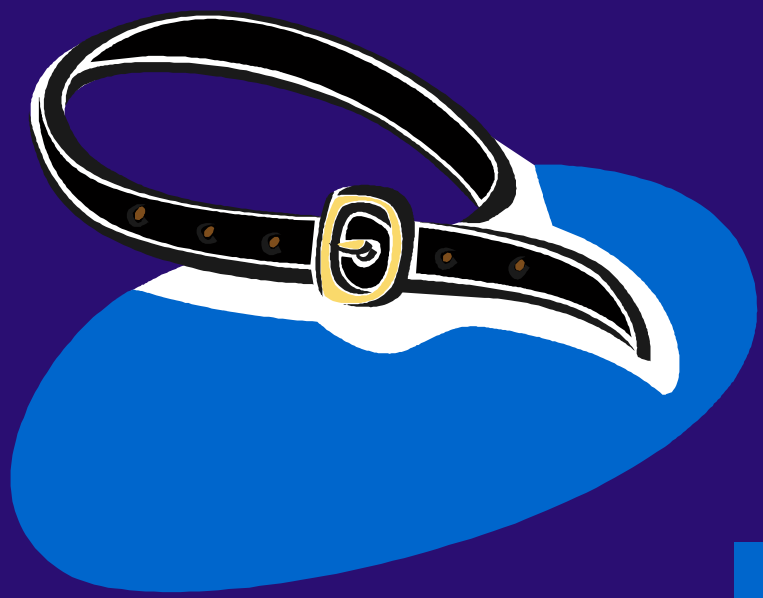
- Measures lumbar and pelvic control in side or sagittal plane
- Can see excessive lumbar lordosis

Observe in Fatigue and Non-fatigue states

Ireland ML, Durbin T, Bolgla Lori. **Gender Differences in Core Strength and Lower Extremity Function During Single Leg Squat.** In: ACL Injuries in the Female Athlete: Causes, Impacts, and Conditioning Programs, Noyes FR, Barber-Westin SD Eds, Springer-Verlag, Berlin Heidelburg, 2012.

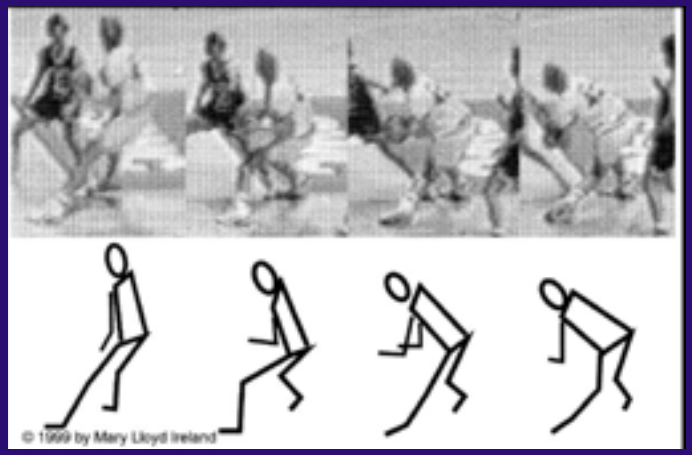
Conclusions

- Simple clinical measures allow testing of athletes in training room setting
- Increase in TF valgus moderately explained by core strength



Single-Leg Squat is the best assessment of altered core stability and neuromuscular activity

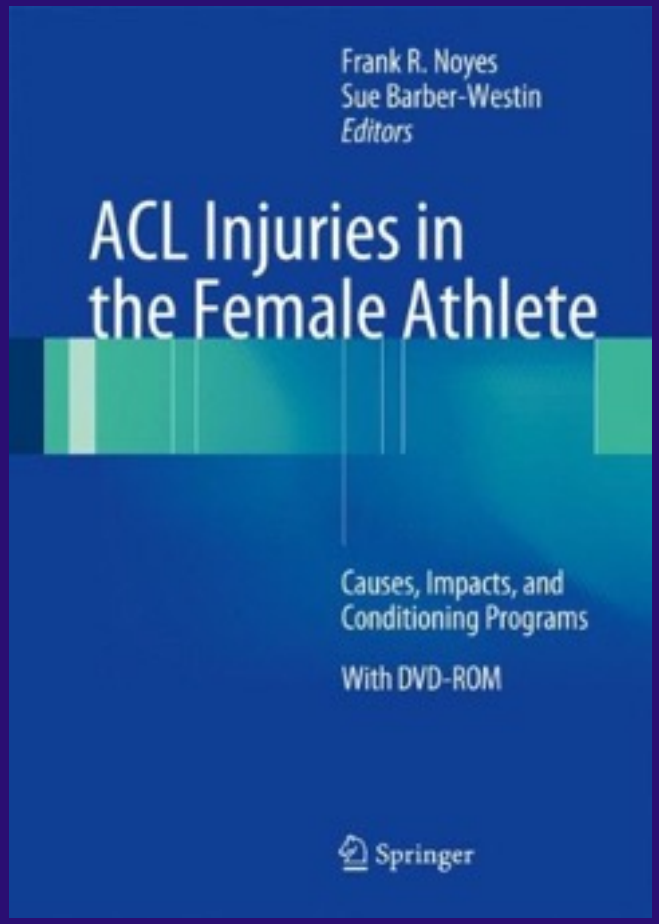
Ireland ML, Durbin T, Bolgla Lori. **Gender Differences in Core Strength and Lower Extremity Function During Single Leg Squat.** In: ACL Injuries in the Female Athlete: Causes, Impacts, and Conditioning Programs, Noyes FR, Barber-Westin SD, Eds. Springer-Verlag, Berlin Heidelburg, 2012.

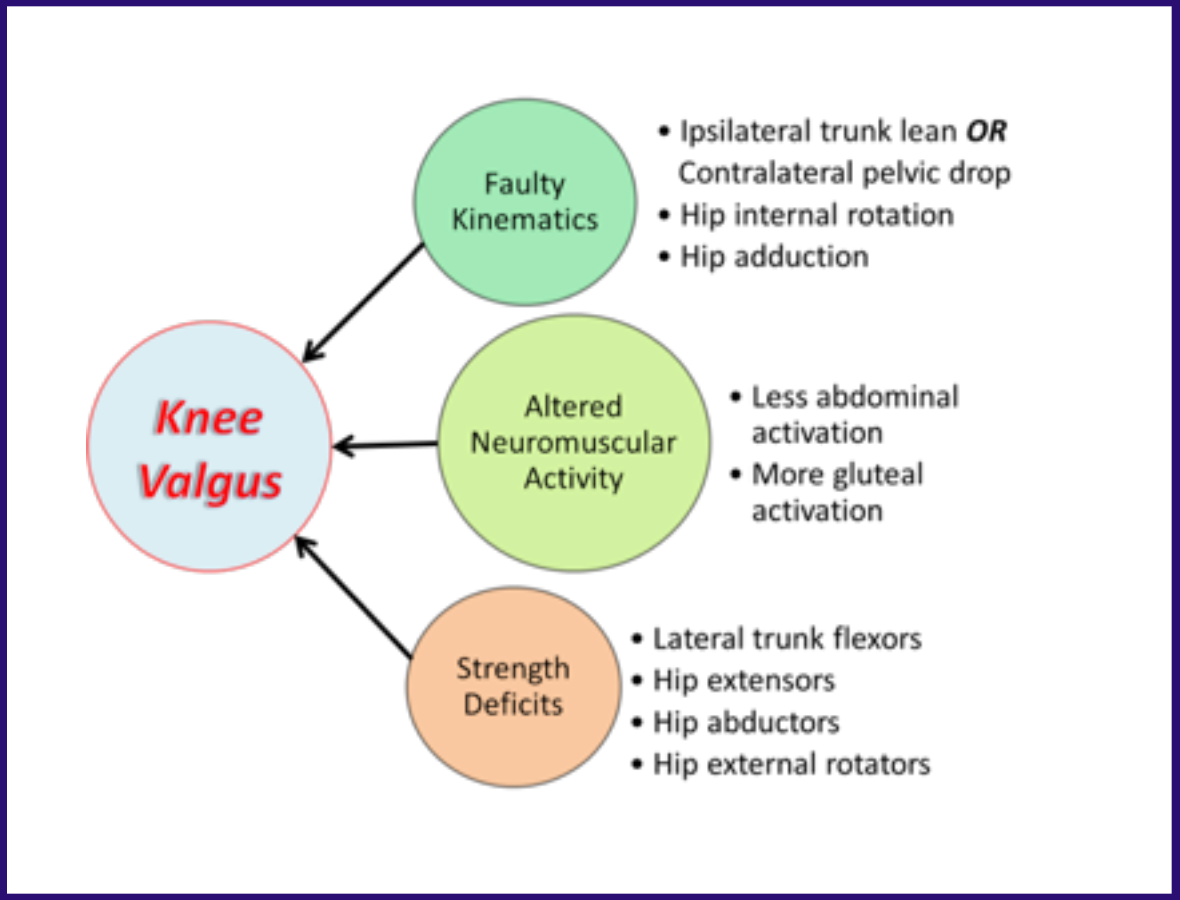


Gender Differences in Core Strength and Lower Extremity Function During the Single-Leg Squat Test

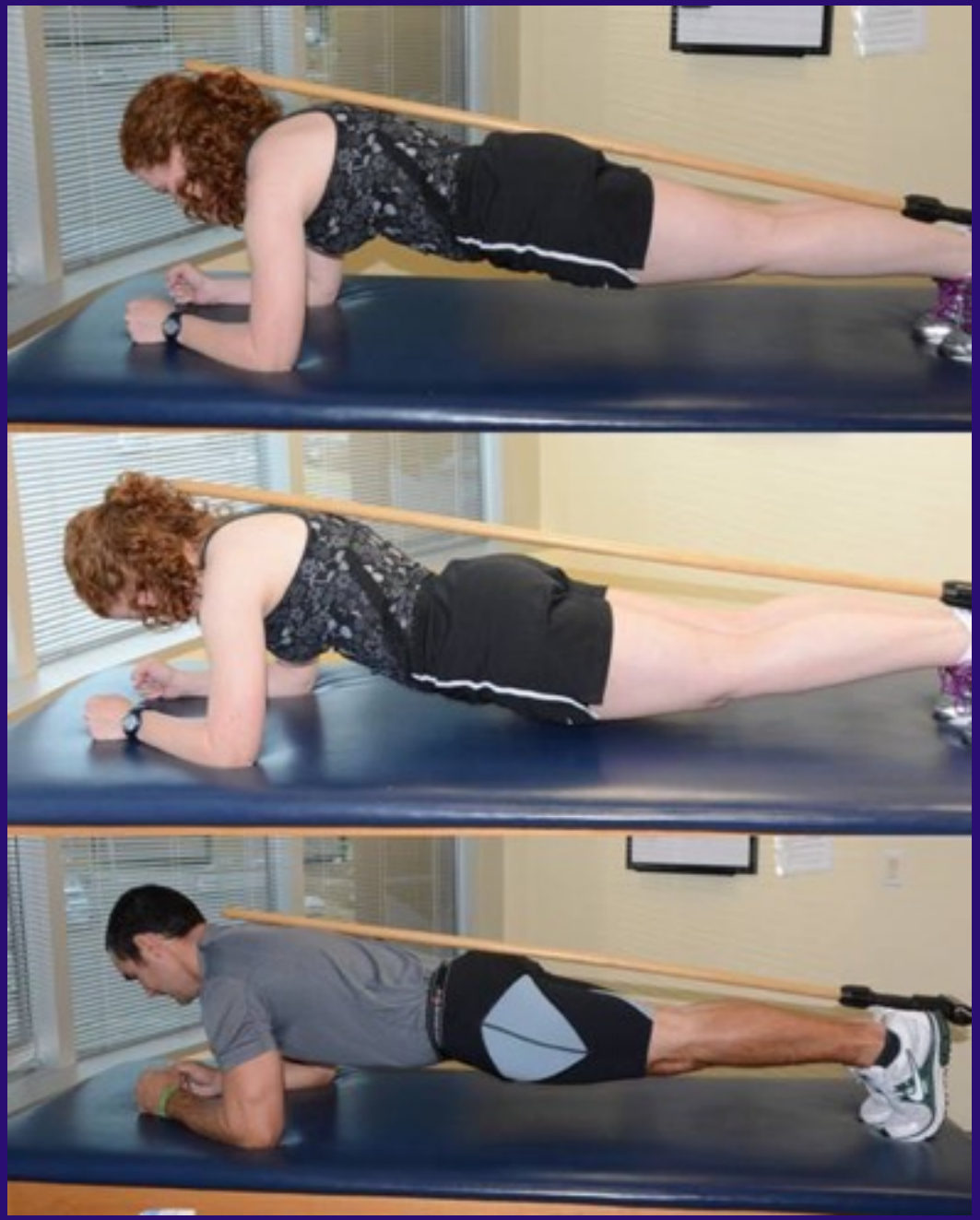
Mary Lloyd Ireland, M.D.
Thomas Durbin, M.D.
Lori A Bolgla, P.T., Ph.D., A.T.C

Knee valgus:
- Faulty Kinematics
- Altered Neuromuscular Activity
- Strength Deficits





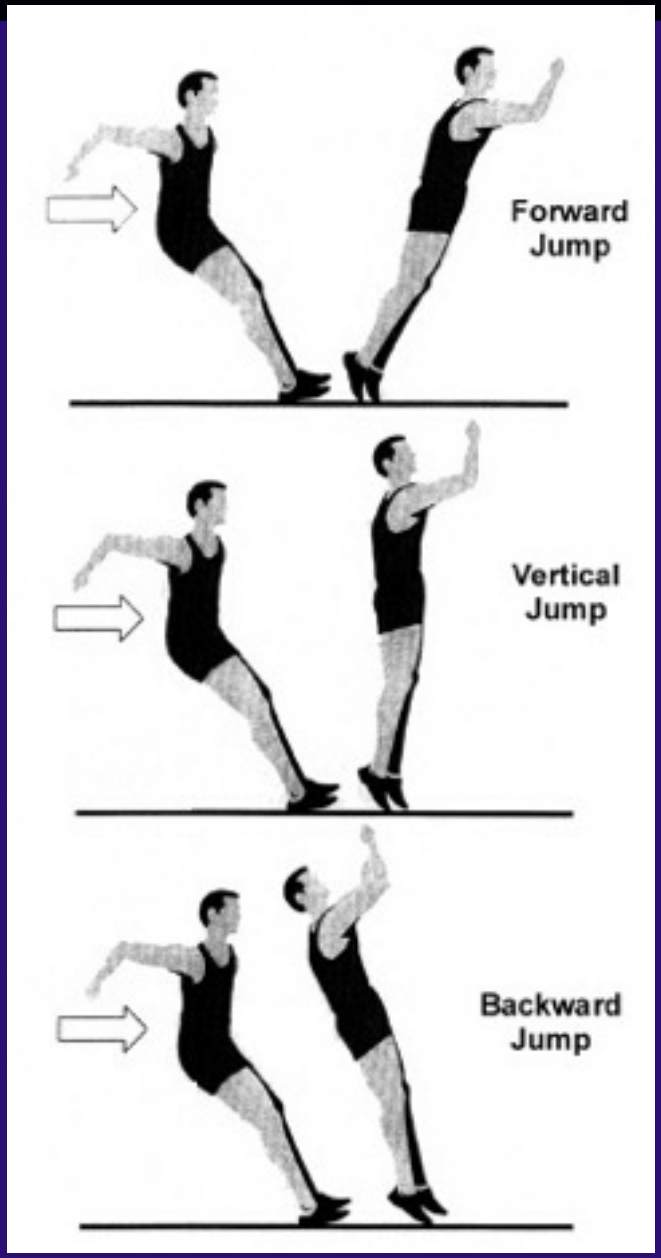
Ireland ML, Durbin T, Bolgla Lori. **Gender Differences in Core Strength and Lower Extremity Function During Single Leg Squat.** In: ACL Injuries in the Female Athlete: Causes, Impacts, and Conditioning Programs, Noyes FR, Barber-Westin SD Eds, Springer-Verlag, Berlin Heidelburg, 2012.



A Comparison of Knee Kinetics between Male and Female Recreational Athletes in Stop-Jump Tasks.

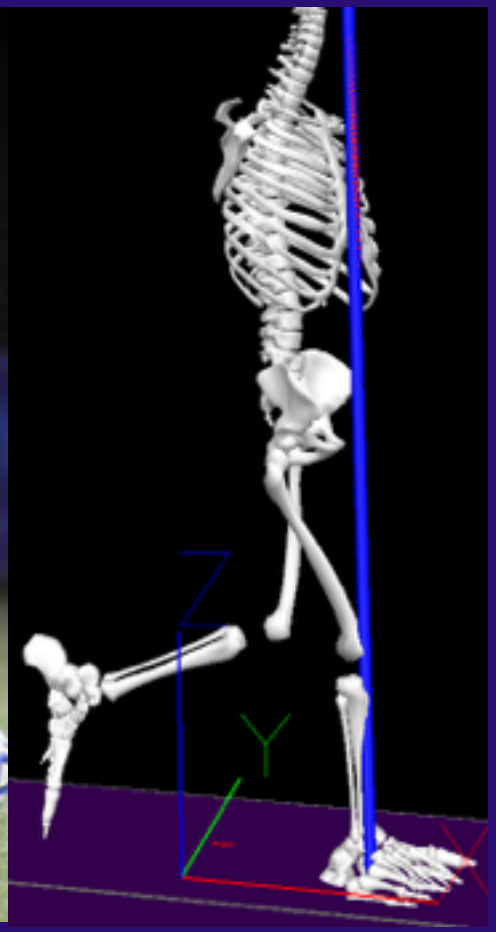
Chappell JD, et. al, Am J Sports Med 30(2);2002: 261-267.

Women had greater knee extension
valgus moment ACL stress greatest
backward stop jump



The Three Stop-Jump Tasks

Ongoing ACL Research at the University of Kentucky



UK Research Team-Gait Lab Brian Noehren,phD New FACSM…….

Presentations at ACSM Meeting 2014

Are Core and Hip Strength Better Predictors of Hop Test Performance?

- Christopher Yonz, MD, Jeremy Burnham, MD, Mary Lloyd Ireland, MD, FACSM, Brian Noehren, PhD, Newly Awarded FACSM

Can Core Strength Influence the Knee Valgus Angle During a Step Down Test?

- Rachelle McKinley, Kaley Robertson, Akash Patel, Christopher Yonz, MD, Jeremy Burnham, MD, Mary Lloyd Ireland, MD, FACSM, Brian Noehren, PhD

Presentations at ACSM Meeting 2014

- The Relationship between Hip Strength and the Y Balance Test
  - Kaley Robertson
- What Does the Single Leg Step Down Test Measure?
  - Jeremy Burnham, MD

ACL Research Current:

- ACL outcomes study: track pre-op, 3,6,9 months after surgery, assess new outcomes tests, gait, and jumping performance

- Currently the study tracks:
  - Functional tests: Trunk control test and endurance, knee frontal and sagittal plane control , quadriceps strength
  - Gait, Drop vertical jump 6 and 9 months
  - 9 months assess sport readiness, put though fatigue protocol reassess functional tests
  - Provide, patients, MD's feedback at 6 months of progress, hope it has immediate (for patients) and long term benefits (practice)

UK Observations Post ACL Recon:

- Running: Greater Hip Flexion
- Does this Protect the Graft?
- Are there greater loading forces?
- Normal running biomechanics are not restored… At 6 months

ARE WE EVER ABLE TO RESTORE NORMAL GAIT PATTERNS?

Assessment of Post Op Kinematics & Moments

- Frontal and Transverse Planes Must be Assessed
- Endurance *vs.* Control
- Fatigue *vs.* Non Fatigue
- Fear *vs.* Confident
- Athletically Gifted *vs.* NOT

Results

Visual Analysis:

R BPB

Soccer 7 months post op

Trunk Control

WHAT are the best tests to do for determining readiness for return to play?

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

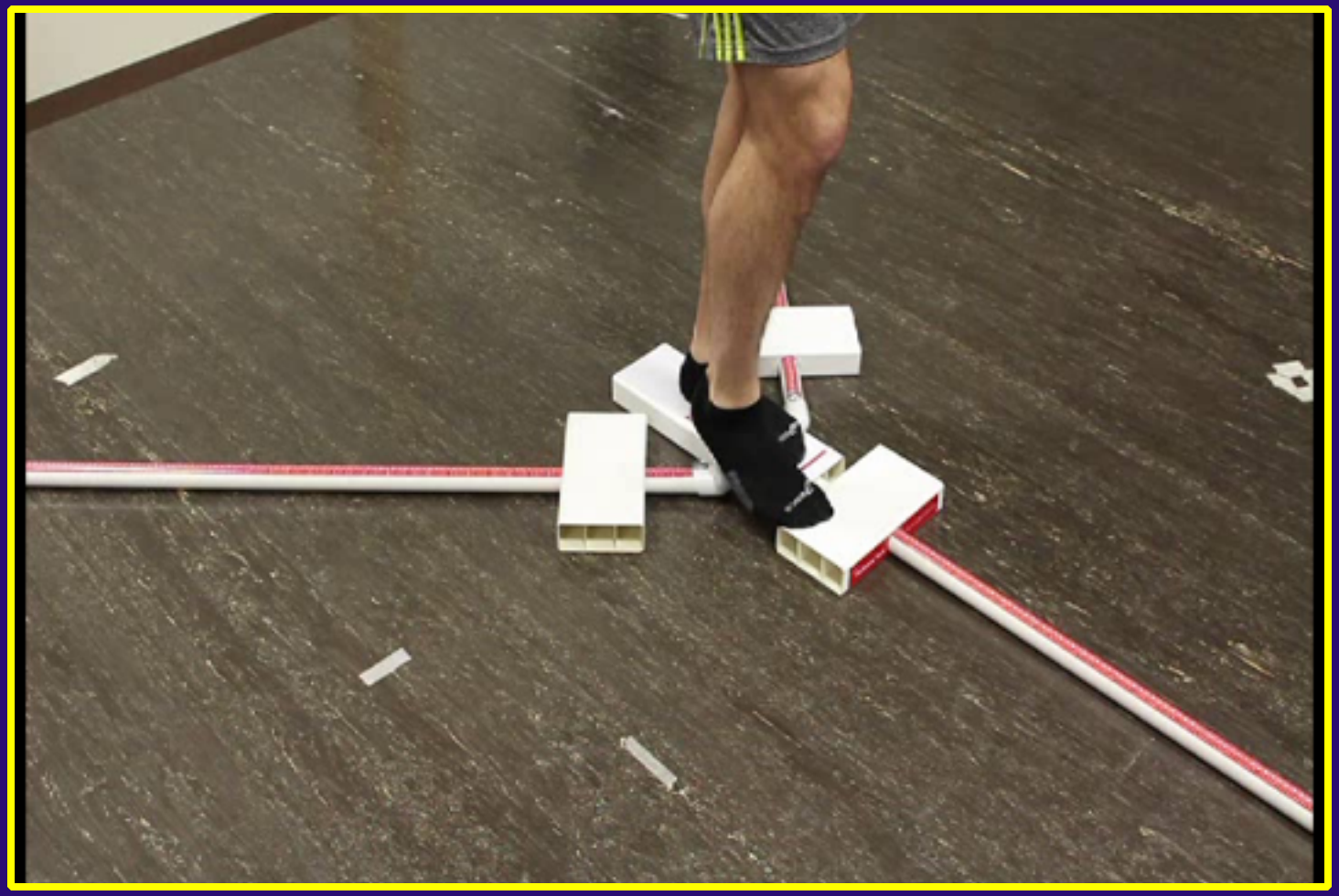
Functional Assessment

Functional Assessment

Single Leg Mini Squat

Trunk Control Test

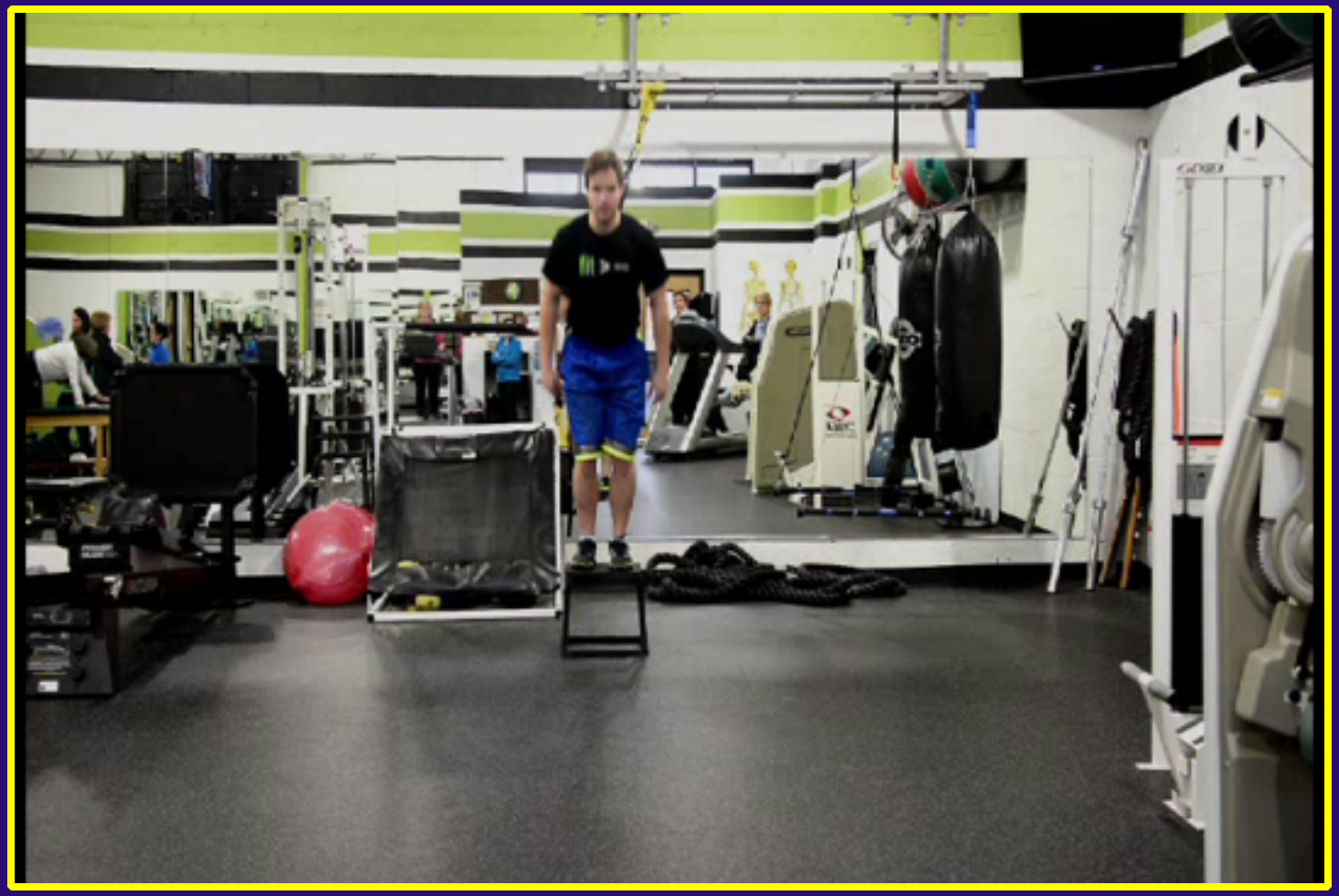
Y Balance



Dynamometer Testing Prone HIP

Front and Side Planks

Jump and Run



Single Leg Balance Catch

Single Leg Balance Foam

Single Leg Balance Foam Hip ER

Bird dog Pointer Trunk/Core Control

Where do we go?

- Think Tanks
  - ACL Retreats
  - Graduate Students, Residents
  - Teams
- Multicenter Funded Studies
- Comparison Groups
  - SEX
  - RACE
  - SPORTS
  - AGES

How Can We Make Functional Testing to Determined Readiness to Play MORE OBJECTIVE?

- Change the subject?
- Adapt to environment?

Pebble toad

Ibex

What We Don't Know…..

- Why she is more likely to tear her ACL.
- What are Risk Factors and Order of Importance ?
- Determine Why prevention programs are working..
- PREVENTION PROGRAMS DO WORK AND SHOULD BE DONE BY ALL ATHLETES AND ACTIVE PEOPLE.

WHAT I KNOW—ALL OF YOU MAY NOT AGREE:

- PRACTICE PROPER LANDING POSTIONS.
- WE SHOULD TRY AND DEVOTE RESOURCES. AVOIDING THE POSITION OF NO RETURN IS KEY.
- PREVENTION IS THE GOAL!

What We Know

- More than we think, if we look at movements pattern…
- Teach children how to land

- Ask more questions
- Look at literature
- Surprising, How Little Basic Research for the Simplest Questions!

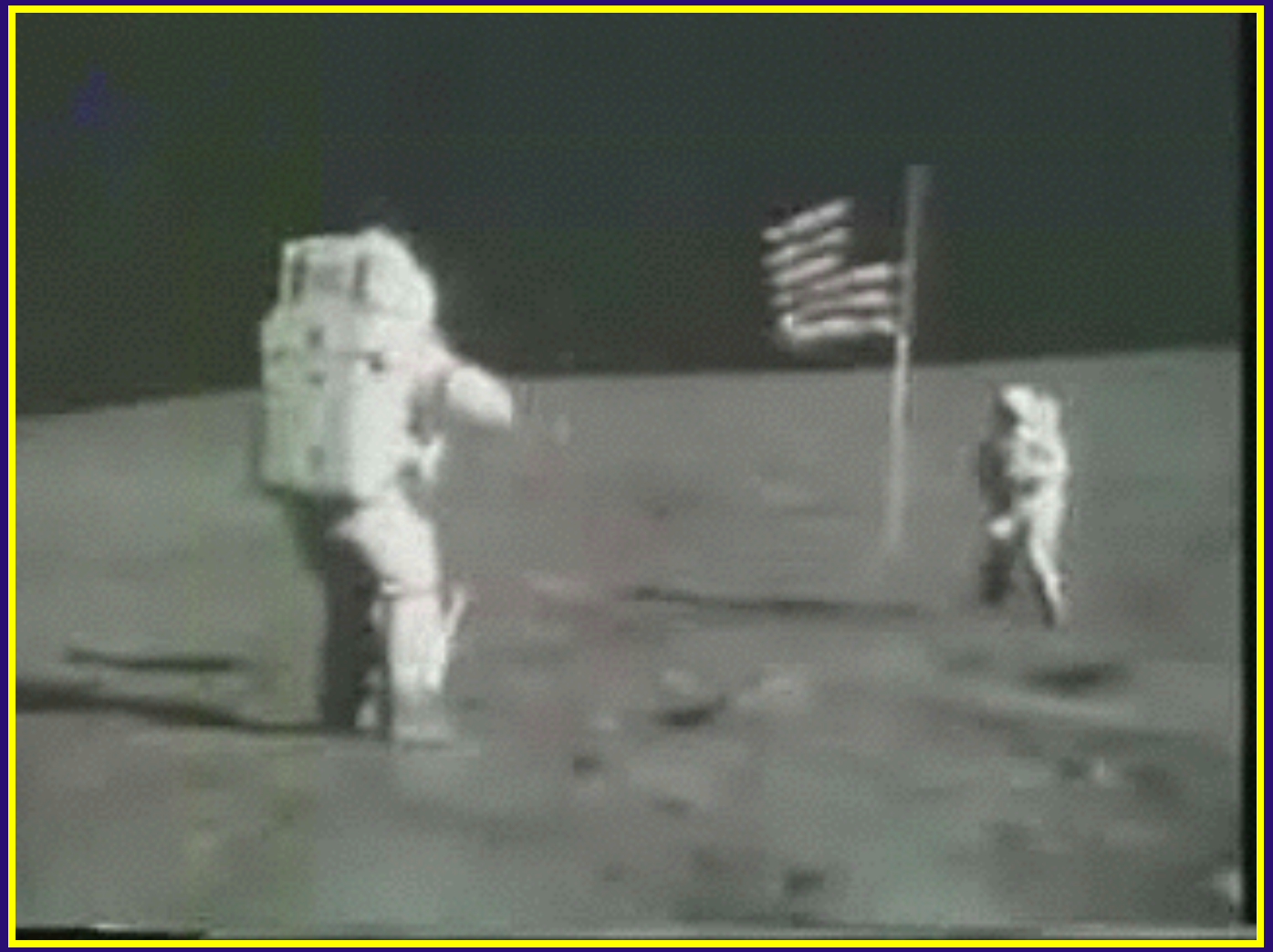
Ireland, ML. "Problems facing the female athlete," in: Pearl, AJ. The athletic female. 1993, 11-18.

" 'Catch a rising star . . . Catch it if you can.' These lines from a children's song should encourage limitless but achievable goals for youngsters. As a child I was encouraged to play as hard and run as fast as I could. If I beat the boys, that was okay."

SPLASH—Rapid improvement by (left to right) Bob Sergent, Mary Lloyd Ireland, Kassie Kessinger and Mark Richards earned the foursome berths on the Greater Lexington Swim Association team which will compete in the 29th Jewish Community Center Meet in St. Louis this weekend. (Leader photo).

Fierce GLSA Competition Uncovers

Landing is EVERYTHING!



The six females attending the AOSSM Meeting,15 years ago

Mary Lloyd Ireland

Liza Arendt

Sandy Kirkley, greatest female orthopaedic surgeon/ researcher EVER, deceased

Jo Hannafin, first female president of AOSSM

Carol Teitz

Ro Morwessel

My Personal 10 Commandments

X. Don't forget your family and your friends.

Clinics in Sports Medicine:

Ireland ML, "Balancing Life as a Team Physician"

John R. Sutton

- Quite a Character I am Told…
- I wish I had known him…
- Keep his words alive by doing research …
- Bring down those ivory towers and all work together…
- Respect and Give Credit to your peers…

We Are So Fortunate. Enjoy the Ride

Privileged to be the 9th Sutton Lecturer

and the First Female!

Thank you, So Much……

Mary Lloyd Ireland, M.D.
University of Kentucky
Dept. of Orthopaedic Surgery
& Sports Medicine